Road Safety Audit for I-380 through the Cities of Cedar Rapids and Hiawatha in Linn County, Iowa

Final Report
March 2009

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16. Abstract

Interstate 380 (I-380) through Cedar Rapids and Hiawatha, Iowa, is a multilane divided urban freeway that was constructed in 1976 to the Cedar River and in 1981 from that point northerly. Traffic volumes vary from 47,000 to 83,500 vehicles per day, with about 8%–15% trucks and buses.

Based on concern for the high number of crash incidents, particularly serious crashes, and increased traffic volumes on this roadway, the City of Cedar Rapids and the Iowa Department of Transportation (Iowa DOT) District 6 Office requested that a road safety audit be conducted for this roadway section. Representatives from the Iowa DOT, Federal Highway Administration, Center for Transportation Research and Education, local law enforcement, local government, and area businesses met to review crash data and discuss potential safety improvements to this segment of I-380.

This report outlines the findings and recommendations of the road safety audit team for addressing the safety concerns on this I-380 corridor and explains several selected mitigation strategies.

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ROAD SAFETY AUDIT FOR I-380 THROUGH THE CITIES OF CEDAR RAPIDS AND HIAWATHA IN LINN COUNTY, IOWA

Final Report
March 2009

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INTRODUCTION

Interstate 380 (I-380) through Cedar Rapids and Hiawatha, Iowa, is a multilane divided urban freeway that was constructed in 1976 to the Cedar River and in 1981 from that point northerly. Traffic volumes vary from 47,000 to 83,500 vehicles per day, with about 8%–15% trucks and buses. Posted speed limits vary from 60 mph to 55 mph through the urban area. Based on concern for the number of crash incidents, particularly serious crashes, and increased traffic volumes on this roadway, the City of Cedar Rapids and the Iowa Department of Transportation (Iowa DOT) District 6 Office requested that a road safety audit be conducted for this roadway section. Of particular concern was the section of I-380 near the Cedar River (5 in 1) Bridge, which is bounded by two compound horizontal curves. The southerly limit of the road safety audit section was the Wright Brothers Boulevard SW interchange in Cedar Rapids, and the northerly terminus was the Boyson Road interchange in Hiawatha.

INITIAL MEETING

On November 12, 2008, the initial meeting of the road safety audit team was conducted at an Iowa DOT office in Cedar Rapids. The following people participated in this meeting:

- Gary Petersen and Ron Griffith, Cedar Rapids Public Works Department
- Capt. Bernard Walther and Sgt. Cory McGarvey, Cedar Rapids Police Department
- Dennis Marks, Hiawatha Police Chief
- Tim Whitney, West Side Transport Company in Cedar Rapids
- Jerry Roche, Federal Highway Administration (FHWA)
- Jack Latterell, Consultant
- Troy Jerman, Tom Storey, Steve Wilson, and Randy Roethlisberger, Iowa DOT
- Tom McDonald, Center for Transportation Research and Education

Following introductions, Tom McDonald explained the purpose and format for the road safety audit, stressing the need for input from all participants. Recent pavement surface friction testing, speed sampling, and crash history data from 2001 to 2007 would be addressed during the meeting, and roadway conditions would be observed during both daylight and nighttime field reviews.

Gary Petersen and Ron Griffith began the meeting by describing several areas of concern for public works personnel. These areas included the southbound exit ramp from I-380 to US 30 and, especially, the section of I-380 between two curves near the central business district, which includes the 5 in 1 Bridge over the Cedar River. This latter section will be referred to in this report as the s-curve area. Right-angle crashes at the IA 100 interchange are also a concern for the City of Cedar Rapids.

Along this section of I-380, two changeable message signs (CMSs) are in place for each direction of travel. The Cedar Rapids Police Department can access these devices for messaging, with restrictions proscribed by the Iowa DOT. A good working relationship exists between Iowa DOT maintenance personnel and the police department in Cedar Rapids. It was suggested by the city's public works representatives that the messages and usage policy for the CMSs be reviewed to determine whether messages could be more descriptive and whether the CMSs could be used more frequently. For example, the signs could provide more specific locations for crashes or potentially hazardous construction zones, such as "exit xx" or "cross street xx." Another use could be to warn of adverse driving conditions during rain, snow, and/or ice events.

The Iowa DOT advised that an ice detection system had been in place on US 30 but has now been removed. However, an automated road weather information system (ARWIS) system is in operation on the 5 in 1 Bridge.

Tim Whitney, representing the West Side Transport Company in Cedar Rapids, advised that one of the company's truck drivers had been killed in a crash near the northbound off-ramp for the 1st Street NW interchange. Visibility of this ramp and the upcoming 5 in 1 Bridge is hampered

by the curvature of the roadway, trees, and the Linn County sheriff's office building, which are located very near the I-380 roadway. Several other truck crashes have occurred in this area, and Whitney was concerned about road conditions, especially when the roads are wet.

Moreover, the 5 in 1 Bridge is preceded by compound curves on each approach. It was stated that the s-curves are a general concern area on this roadway, but travel at the posted speed of 55 mph or even slightly higher should be no problem under normal driving conditions. According to the original project plans, the design speed of the roadway through this area is 60 mph. In the past, the Cedar Rapids Police Department and Cedar Rapids Public Works Department have suggested lowering the speed limit to 45–50 mph. According to Cedar Rapids and Hiawatha police officials, driving at speeds in excess of the posted limit is a problem, especially during adverse or wet weather conditions.

Sgt. McGarvey reported that approximately 20 serious crashes had occurred on this segment of I-380 in 2008 that were not listed in the road safety audit's analysis period (2001–2007). Two fatal crashes with at least three fatalities were included in those 20 serious crashes. All of these crashes had occurred in the section between H Avenue southerly through the s-curve area, and almost all involved local residents in a single vehicle and a loss of control by the drivers. The fatal crash involved a crossed-median movement from the northbound lanes near 7th Street NE on a clear, dry Tuesday. Another fatal crash occurred in November in a chain reaction incident.

It was noted that traffic volumes have increased and more drivers in the traffic stream are unfamiliar with the roadway since I-380 was designated as part of the "Avenue of the Saints" several years ago.

The Cedar Rapids Public Works Department maintains an annually updated priority list of city intersections, based on crash rate and number of crashes. Most intersections on this list may have 18–20 annual crashes recorded. Probably only one of the I-380 ramp terminals, 1st Avenue west, would approach this threshold, based on the data for the past seven years.

During this initial meeting, the results of recent friction testing and speed monitoring were presented and discussed. The friction values were considered acceptable. However, team members made several comments about driver-reported significantly reduced friction when drivers pass over the steel bridge expansion joint plates. Copies of selected crash data were provided to the team members for examination and reference during this meeting and field reviews to be conducted later.

In addition to the crash history, speed sampling, and friction testing data, this report will refer to a 1986 review of the I-380 corridor through Cedar Rapids that was conducted by the FHWA, Iowa DOT, and the City of Cedar Rapids. Results and recommendations from that field trip report, entitled "A Human Factors Evaluation of Four Locations on Interstate 380 in Cedar Rapids, Iowa," will be reviewed and discussed later in this final report.

FIELD REVIEWS

Daylight Review

Following lunch, the audit team conducted a daylight review of I-380 through Cedar Rapids and Hiawatha to observe, as much as possible, roadway and operating conditions. The review began at the Wright Brothers Interchange and proceeded northerly. The posted speed limit at this location is 70 mph.

In addition to observations of mainline I-380, ramp and termini conditions were reviewed at several interchanges, including Wilson Avenue, 1st Avenue, Collins Road, Blairs Ferry Road, and Boyson Road.

In the northbound lanes, the first CMS is located approximately at mile post (MP) 15, where the posted speed limit lowers to 60 mph just south of the US 30 interchange. A second CMS in the northbound lanes is located just north of 16th Avenue SW, and the posted speed limit lowers to 55 mph at approximately MP 19 at this same location. It was noted that MP markers are not easy to read, especially the tenth-mile markers, which are taped to individual delineator posts. Most warning signs throughout the audit area appear quite old and faded and most likely do not have micro-prismatic sheeting.

In the southbound direction, the initial CMS is located just north of the Boyson Road interchange, with a second CMS located at 29th Street NE.

The law enforcement officers in the audit team noted that traffic surveillance and apprehension of violators are both difficult at best through the s-curve area.

The original metal handrail exists on the 5 in 1 Bridge, and some truck crashes involving this rail have occurred during the crash analysis period of the past seven years. Several trucks have completely penetrated the rail, and more than one had fallen to the ground below.

Following the s-curve area, the roadway again has a posted speed limit of 60 mph just south of Coldstream Avenue NE. Two cross-median fatal crashes had occurred in this area near H Avenue NE and J Avenue NE, where a narrow (40 feet wide) grass median exists.

Gary Petersen observed that enhanced alignment warning signs approaching the s-curve area would provide important information for unfamiliar drivers. Larger, possibly fluorescent yellow warning signs installed on both sides of the roadway or overhead should be considered to replace the current signs, which are in poor condition.

The I-380 southbound off-ramp terminal at 1st Avenue W exhibits smaller guide and regulatory signs, especially turn prohibition signs. Pavement markings in this area are also quite worn.

Throughout the I-380 urban section, durable epoxy pavement markings have been installed with an expected approximate five-year life of effectiveness. However, these markings appeared well worn throughout the corridor during the field review. Delineation of gore areas was noted as a possible beneficial enhancement.

The advance guide signing that designates lane assignment at the SB bifurcation area near the US 30 interchange has been a concern for the City of Cedar Rapids. Several crashes have occurred at this location in the past. Consideration should be given to improving guidance for drivers approaching and traveling through this area.

It was noted that the Iowa DOT is developing an intelligent transportation (IT) proposal for Cedar Rapids that could be advantageous for the I-380 corridor. Tom McDonald will contact Michael Jackson and Willy Sorenson at the Iowa DOT's Research and Technology Bureau to discuss the preliminary plan, and Jerry Roche also planned to follow up on this issue. In addition, the Iowa DOT has established a Traffic Management Center in the Office of Maintenance. This office will also be contacted to determine interest in the I-380 urban section. More information about the IT proposal and Traffic Management Center are included later in this report.

Nighttime Review

Following dinner, a nighttime field observation of the corridor was conducted. Participating in this review were Gary Petersen, Ron Griffith, Sgt. McGarvey, Tom Storey, Steve Wilson, Jerry Roche, Jack Latterell, Troy Jerman, and Tom McDonald.

The route was examined in the same manner as the daytime review, beginning at the Wright Brothers Interchange and proceeding northerly. As during the daylight observations conditions on the I-380 mainline lanes were noted and interchange ramp termini were reviewed for signal visibility and lighting needs. The Collins Road, Blairs Ferry Road, and Boyson Road interchanges were reviewed in more depth, with special attention paid to traffic signal, signing, and pavement marking visibility.

Roadway lighting was uniform and mostly satisfactory south of the s-curve area, although several bulbs were burned out, but northerly from there lighting was not continuous, and the resultant dark areas were quite noticeable. Signal visibility and lighting appeared satisfactory at the Wilson Avenue interchange.

Pavement marking visibility was poor in many areas of the mainline roadway, and delineator reflectors were not performing well. In addition, several off-ramp gores, especially the larger area gores, were delineated only with pavement edge line markings and would be unsatisfactory for driver guidance.

Bridge railings, both concrete and metal, were not highly visible, especially where overhead lighting was not available. Additional guidance for drivers would be beneficial in those areas.

At the 1st Street NW off-ramp terminus, (exit 19), visibility of traffic signal indications and overhead guide signs was hampered by interference from a street lamp beside one of the signal heads. The 1st Avenue westbound off-ramp from southbound I-380 would benefit from improved signing and pavement markings. The ramp termini should be studied for improvement.

WRAP-UP MEETING

On November 13th, 2008, a wrap-up meeting for the road safety audit was conducted in an Iowa DOT office. Participating in this meeting were all audit team members, plus Jeff Tjaden of Iowa DOT maintenance.

Tom McDonald opened the meeting by reviewing the observations made by the team during the daylight and nighttime reviews of the previous day.

Numerous comments were made by other team members, including the following:

- Ron Griffith advised that the City of Cedar Rapids is using diamond grade cubed, type 11 sheeting for guide signs, including street name signs, in an effort to improve conspicuity. The city is also using larger fonts for guide signs per the most recent edition of the Manual on Uniform Traffic Control Devices (MUTCD).
- Gary Petersen advised that the City of Cedar Rapids followed Institute of Transportation Engineers (ITE) standards for establishing yellow and all-red signal phases. Coordination of signals is established where possible, and all signals have 12 in. LED lamps.
- The City of Cedar Rapids Public Works Department also records all crashes below the reporting threshold ($1,000) to include these in safety and operational analyses using the TraCS software program and the IMAT software for analysis.
- The City of Cedar Rapids suggested that the cantilever guide sign assembly for southbound traffic just south of the 33rd Avenue SW interchange be replaced with complete lane assignment signing on a full truss.
- Jack Latterell suggested that smooth tire friction testing be undertaken on I-380, especially in the s-curve area, to approximate “worst case” conditions for friction.
- It was suggested that the City of Cedar Rapids and the Iowa DOT consult on preferred lane marking for the southbound ramp bifurcation area at the US 30 interchange. According to Tom Storey, the work for hot mixed asphalt (HMA) resurfacing of that area is under contract and will be completed in early 2009.
- The number of large truck crashes involving bridge handrail impacts on the 5 in 1 Bridge has been investigated and is included in this road safety audit report.
- It was also suggested that a media news release be developed to advise drivers of the road safety audit activities and the recommendations for improvement resulting from this audit.

Subsequent to the road safety audit, comments were received from the Cedar Rapids Police Department expressing safety concerns for I-380 through the city, as well as for US 30 within the department’s jurisdiction, especially during investigation of the numerous crashes that occur on those two routes. The Chief of Police emphasized several recommendations:

1. The speed limit on I-380 through the s-curves should be reduced to 45 mph.
2. The speed limit on I-380 through the other sections within the city limits should be reduced to 55 mph.
3. The speed limit on US 30 through the city limits should be reduced to 55 mph.

4. The Cedar Rapids Police Department requests that median crossovers be installed on I-380 to provide locations for speed enforcement activities.

The top priority for the Cedar Rapids Police Department is public safety, and this includes the safety of the officers and other public employees called to the crash scenes on I-380.

To discuss issues like those raised by the Cedar Rapids Police Department, it would appear that this would be an excellent opportunity to establish a multi-disciplinary team in the Cedar Rapids metropolitan area that would include law enforcement from all cities and Linn County; the Metropolitan Planning Agency; transportation agencies from the state, city, and county; and any other agencies that have an interest in roadway safety. These multi-disciplinary teams have been highly effective in other areas of Iowa and could be in Cedar Rapids as well. The Governor's Traffic Safety Bureau will be urged to initiate discussions with the potential team members.

SUMMARY OF DATA

Speed Sampling

The Iowa DOT sampled vehicular speed in the corridor using an automated traffic recorder (ATR) located just south of Coldstream Avenue NE in August of 2008. Results of that sampling indicated an average speed for northbound vehicles of 63.3 mph and an average of 61.9 mph for southbound traffic, for an average of 62.6 mph for both directions of travel. The average speed thus indicated fairly good compliance with the posted speed limit in this area of 60 mph.

However, the area of particular interest for speed compliance is between the s curves on either side of the 5 in 1 Bridge, and no speed sampling data were available for this location.

Complete results of the speed testing are included in Appendix A.

Friction Testing

The Iowa DOT performed pavement surface friction testing in the area of the 5 in 1 Bridge in June 2008. Results ranged from 31 to 51 in the northbound direction and from 31 to 47 in the southbound direction. Lower friction numbers were generally measured in the outside lanes. Since some of these tests indicated friction levels below the "trigger" values described in Maintenance Policy and Procedures Manual 600.01, the Iowa DOT District Office may wish to review potential strategies to address this issue. Complete friction testing results are included in Appendix B.

Crash History

For this safety audit, the crash history of this section of I-380 was investigated using Iowa's extensive crash database. Data were reviewed for the years of 2001 through 2007. Selected crash data for mainline I-380 and the interchange termini are included in Appendix C, and complete copies of the crash data are on file at the CTRE office.

Mainline I-380

During that time period for only mainline I-380, a total of 847 crashes were recorded, including 7 fatal crashes, 21 major injury crashes, 99 minor injury crashes, 168 possible injury crashes, and 552 property damage only (PDO) crashes. Of the 1,612 drivers involved in the 847 crashes, a total of 394 injuries occurred, including 12 fatalities, 28 major injuries, 134 minor injuries, and 205 possible injuries.

The most common crash causes for mainline crashes were speed-related, such as driving too fast for conditions, swerving/evasive action, and lost control. Following too closely was also reported often.

The most common manner of collision for these crashes was rear-end and sideswipe-same direction. The recorded number of head-on crashes was low, but these accounted for 5 fatalities and 5 major injuries. One fatal crash in 2008 involved a single vehicle that crossed the median and impacted a bridge abutment in the opposing lanes. Non-collision crashes constituted 217 of the total 847 mainline crashes.

The months with the most crashes were January followed by December, possibly indicating weather-related contributing factors. The day of the week on which crashes occurred was fairly consistent during the work week, with most crashes recorded on Fridays. The number of crashes on weekends was much lower than for weekdays, probably indicating higher traffic levels during the work week. The highest number of mainline crashes occurred during rush hours, with 6:00 a.m. to 8:00 a.m. showing the highest numbers, followed by 4:00 p.m. to 6:00 p.m. and then 2:00 p.m. to 4:00 p.m. These data may be indicative of higher traffic volumes during these time periods. Much lower numbers of crashes occurred during the nighttime hours.

Younger drivers were most commonly involved in the recorded crashes, with drivers between the ages of 15 and 24 representing the highest percentage (approximately 28%), followed by the 25–34 year old group (about 21%). Drivers 65 years and older only constituted approximately 5% of the total 1,612 drivers involved in the 847 mainline crashes.

Driver condition was judged apparently normal approximately 65% of the time, and drivers under the influence of alcohol/drugs/medication were recorded less than 5% of the time.

Weather conditions during these crashes were recorded as clear for approximately 43% of the crashes and cloudy or partly cloudy for about 22% of the crashes. Adverse weather conditions involving rain or mist were recorded for about 10% of the crashes, and snow or sleet/hail/freezing rain was recorded for about 16% of the total number of crashes. However, most serious crashes, fatalities, and/or major injuries did not occur during adverse weather.

Pavement surface conditions during the crashes were observed as dry over 58% in the time. Wet pavement was present for over 13% of the mainline crashes, and either ice, snow, or slush was observed for over 19% of the reported crashes.

For the 847 mainline crashes, 524 (almost 62%) occurred during daylight hours, 160 crashes (about 19%) were recorded during nighttime hours on lighted sections of roadway, and 48 crashes (about 6%) occurred at night on unlighted sections of I-380. It is interesting to note that among those 48 crashes there were 5 fatalities and 6 major injuries, while another 5 fatalities and 4 major injuries occurred during the night on the lighted sections of roadway. Crash severity tended to be much higher during nighttime hours.

Ran off road was recorded as a major cause for 68 of the 847 mainline crashes. For these and other crashes listed as non-collisions, the most frequent objects struck were guardrails (about 34%), bridges or other structures (20%), and multiple objects (14%).

When direction of travel (northbound or southbound) for the mainline crashes is examined, a remarkable balance is observed for both the number of crashes and crash severity. However, only about one-half of the PDO crashes recorded direction of travel, perhaps due to the fact that a high number of these crash reports were prepared and submitted by the drivers, not police officers.

5 in 1 Bridge at Cedar River

During the safety audit meetings, it was pointed out by Cedar Rapids law enforcement and Iowa DOT maintenance personnel that numerous crashes involving large trucks had occurred on the 5 in 1 Bridge over the Cedar River, and some trucks had penetrated the bridge rail during those events.

Subsequent to the audit, additional crash history was reviewed to analyze these observations. For the area of I-380 between 1st Avenue westbound and 1st Street East that includes the Cedar River Bridge, a total of 139 crashes occurred during a period from 2001 through most of 2008, including one fatal crash and four major injury crashes.

For the specific crashes involving trucks/trailers, 21 were recorded over this more than seven-year period, 18 of which were semi-trailers and 1 of which was a triple trailer. These crashes resulted in one fatality and eight total injuries. Also recorded was approximately $862,000 in property damages. Impact with guardrail or impact attenuator was listed in the sequence of events for 11 of these crashes. Five crashes involved a jackknife by the trailer unit. Pavement surface conditions were recorded as wet for all but one crash, almost all occurred during non-winter months, and most occurred during the work week. The major cause for these crashes was listed as speed-related about eight times, when this piece of data was included in the crash report. All drivers involved in these crashes were recorded as apparently normal, all were males, and only one was 25 years or younger. From the very high property damage loss noted in several of these crashes, it can probably be concluded that penetration of the bridge handrail may have occurred several times, as all but one of the high property loss crashes recorded an impact with guardrail.

Interchanges

There are a total of 15 full or partial interchanges on the safety audit section of I-380, including a free flowing clover leaf interchange with US 30 near the southerly terminus. Ramp termini with higher traffic volumes at several of these interchanges have experienced numerous crashes over the seven-year review period, particularly those termini controlled with traffic signals. Maintenance and operation of the signals are the responsibility of the City of Cedar Rapids. It should be noted that, with a few exceptions, these crashes were almost all PDO or of low injury severity, as would be expected at low-speed intersections. Experience at selected termini that have higher crash incidence are discussed below.

Wright Brothers Boulevard SW

A total of 17 crashes resulting in 7 injuries occurred at the west terminal, and 21 crashes resulting in 6 injuries were recorded at the east terminal. However, both of these termini have been signalized recently, and therefore the number and type of crashes at this interchange are expected to change in the future.

Wilson Avenue SW

Twenty-eight crashes with 13 injuries occurred at the west terminal, and 25 crashes with 14 injuries, including one fatality, were recorded at the east terminal. Both of these intersections are controlled by traffic signals, and many of the crashes appear to be related to signal violations. The field reviews of these terminals indicated satisfactory visibility of the signal heads, although it was noted that the signal phasing could be confusing for eastbound Wilson Avenue traffic at the east terminal.

1st Avenue W

Over the review period, the east terminal of 1st Avenue was the site of 43 crashes with 12 injuries. Several of these crashes were also related to signal compliance, with numerous left turning crashes recorded. Additionally, a high percentage of these crashes occurred during nighttime hours, and street lighting may be inadequate at this location.

The west terminal experienced 73 total crashes with 31 injuries. Again, numerous signal violation–type crashes were recorded at this intersection, and several left turning crashes had occurred.

H or J Avenue NE

The east terminal of this interchange was the site of 27 crashes with 10 injuries. As with the termini discussed above, most of the crashes at this location were signal related.

Coldstream Avenue NE and Glass Road NE

These partial interchanges are connected by frontage roads on each side of I-380. The east terminal of Coldstream Avenue, which is the northbound I-380 off-ramp, experienced 30 crashes with 7 injuries. The west terminal only saw 5 crashes, but 4 resulted in injuries. At Glass Road, 15 crashes with 8 injuries occurred at the west terminal, but 26 crashes involving 15 injuries, two of which were major, were recorded at the east terminal, which feeds the northbound I-380 on-ramp. Again, many of these crashes appear to be traffic signal related.

Blairs Ferry Road

This interchange, along with Collins Road just to the south, are the interchanges on I-380 in Cedar Rapids with the highest traffic volumes, and consequently these interchanges are also the site of a high number of crashes. At the east terminal of Blairs Ferry Road, 101 crashes were recorded, over one-third of which involved injuries, including one major injury. Recognition and compliance with the traffic signal by westbound traffic on Blairs Ferry Road just east of I-380 is problematic, as numerous rear-end crashes were noted at that location. In addition, a high number of signal violation crashes and crashes related to left turns occurred.

The west terminal of this interchange experienced fewer crashes, 34 total, with 18 injuries. However, as with the many other interchanges, many crashes appear to be signal related.

Boyson Road

The final interchange in the review area is at Boyson Road, which is located in the City of Hiawatha. The west terminal here experienced 11 total crashes, 4 of which involved injuries, and one was a fatality. The east terminal experienced 20 total crashes, including 9 injuries. At least half of the crashes at this location were rear-end collisions in the westbound lanes. Signal visibility should be reviewed at this location and enhanced as needed.

In addition to the termini, several crashes occurred on the ramps approaching or exiting these intersections. However, neither the total number nor the severity of these crashes were significant, and a discussion of these crashes is not included in this report.

PREVIOUS REVIEW

In April 1986, a review was conducted of the operational problems and safety concerns in the I-380 corridor by the FHWA, Iowa DOT, City of Cedar Rapids Public Works Department, and law enforcement officers from city, county, and state departments. The review was headed by an engineering psychologist from the FHWA, an expert on human factors. The findings of the 1986 review were published in a report entitled "A Human Factors Evaluation of Four Locations on Interstate 380 in Cedar Rapids, Iowa."

Four locations on I-380 were examined in detail during this review: the US 30/US 218 interchange, 1st Street/E and F Avenues, Collins Road interchange, and the section of I-380 from 32nd Street NE to 33rd Avenue SW. In addition to field reviews and office discussions, crash history, site plans, and other supporting data were examined in a process very similar to that followed for safety audits.

Conditions at these same locations observed during the road safety audit revealed some similarities and some variations between the 1986 and 2008 reviews. For example, many deficiencies noted in 1986 at the 1st Street/E and F Avenues interchange seemed to have been addressed, and conditions had improved by 2008. However, at Collins Road traffic volumes have increased significantly, and operational problems and safety concerns have developed here and at Blairs Ferry Road just to the north. Many of the problems noted at the US 30/US 218 interchange remain much as described in the 1986 report, although some improvements have been made in lane assignment signing.

For the section of I-380 between 32nd Street NE and 33rd Avenue SW, especially the curvilinear alignment on either side of the Cedar River Bridge, conditions and problems remain that are similar to those described in 1986. Although current crash data do not indicate a high number of crashes due to icing on this bridge, weather conditions certainly may be contributing to many crashes. The need for real-time messaging for driver information still exists, as recommended in the 1986 report.

One final recommendation from the 1986 human factors review was for the establishment of a multi-disciplinary traffic management action team for I-380 and other high-volume roadways in the Cedar Rapids area. That recommendation will also be addressed in this road safety audit report.

A complete copy of the 1986 report is on file at the CTRE office.

FOLLOW-UP DISCUSSION ABOUT INTELLIGENT TRANSPORTATION SYSTEMS

Future Intelligent Transportation System Plans

Following the road safety audit activities, Tom McDonald visited with Michael Jackson and Willy Sorenson of the Iowa DOT to gather information about installation of intelligent transportation systems (ITS) around the state and the applicability of those systems to I-380 in Cedar Rapids.

Both Jackson and Sorenson furnished information about current ITS applications deployed by the Iowa DOT and advised of possible future installations. The Iowa DOT and City of Cedar Rapids have been discussing the possibility of installing cameras and road sensors in the city for some time, and a map of preliminary camera and sensor locations has been developed. At this time, it is anticipated that a system could be installed in Cedar Rapids following completion of a similar installation in the Council Bluffs area. A possible date for deployment would be in 2011 or 2012. Such a system has been deployed in the Iowa City area extending to the I-380 interchange with US 30, where the sensors monitor traffic speeds and volumes. Information about these systems is available on the 511 website at www.511ia.org.

Any cameras that would be installed in Cedar Rapids would be connected using fiber cable, as wireless installations have proven less reliable. The system would be accessible to local agencies.

An ice detection camera system that uses infrared detectors is being installed on the I-74 Mississippi River bridge in Davenport. If proven reliable and necessary, a similar system may be used on the Cedar River Bridge on I-380.

Statewide Traffic Management Center

Jackson and Sorenson also advised that a traffic management center has been established in the Iowa DOT's Office of Maintenance to help coordinate emergency operations and provide roadway condition information to Iowa DOT field offices, interested agencies, and the public. John Haas is the director, and a staff of one or two people operates the center on a 24/7 basis year-round. Information is provided to the 511 system, CMS messaging can be handled from the center, and camera systems across the state can be monitored. The center's office is located in the basement of the Iowa DOT's administration building in Ames.

SUGGESTIONS FOR POSSIBLE MITIGATION

Based on a review of available data, observations made during this safety audit and comments from team members during review activities, the following suggestions for improvements in the I-380 corridor through Cedar Rapids and Hiawatha are offered. These suggestions are divided into shorter term, lower cost solutions and longer term, higher cost improvements.

Shorter Term, Lower Cost Options

- Initiate actions to establish an active multi-disciplinary team for the Cedar Rapids area. Similar teams have been quite successful in other areas of Iowa in addressing mutual traffic safety concerns among various agencies.
- Replace signing along the entire corridor, with warning signs as the highest priority, followed by guide and regulatory signs. Fluorescent yellow sheeting should be specified for the warning signs.
- Replace all delineators along the route and add 1/10 mile markers.
- Install guidance devices on all concrete and metal bridge rails in the corridor, especially concentrating on the 5 in 1 Bridge and other bridges in the US 30 interchange. Several options are available for this purpose, including retro-reflectors, high-visibility tape, and paint.
- Replace all burned-out bulbs in the roadway lamps and install new lighting in areas where none now exists north from the central business district. Study the need for additional lighting for southbound I-380 south of H Avenue NE.
- Upgrade and replace all pavement markings along the route, considering rumble striping where possible or milled-in all-weather paint markings.
- Study traffic signal modifications at the east terminus of the Wilson Avenue interchange to avoid driver confusion that may be caused by the lagging left turn for eastbound Wilson Avenue at this location.
- Remove the trees along the northbound lanes at the 1st Street NW off-ramp that are located in the right-of-way.
- Review the I-380 southbound to 1st Avenue westbound off-ramp for signing and pavement marking improvements. Replace turn restriction signs with larger, more visible devices.
- Place “Watch for Stopped Traffic” warning signs along the right side of the 1st Avenue W off-ramp prior to the termini.
- The Iowa DOT should consult with the City of Cedar Rapids for desired lane markings at the US 30 southbound off-ramps prior to completing a hot-mix asphalt (HMA resurfacing project at that location in spring 2009.
- The Cedar Rapids Police Department and Iowa DOT maintenance personnel should work together to develop acceptable messaging and operation of advisory notices for drivers using the existing CMS devices.
- Install high-tension cable rail in the narrow (40 ft wide) median areas, especially north from the central business area where several cross-median crashes have occurred.

- Review all unshielded bridge piers throughout the corridor for shielding needs, using high-tensile cable rail where warranted. Specific areas of concern would include along the outside of horizontal curves and locations where crashes have occurred.
- In cooperation with the Iowa DOT's Department of Marketing and Media, the Iowa DOT District 6 Office should develop a media news release describing the suggestions made by the road safety audit team and the proposed improvements to be pursued by the Iowa DOT and the cities of Cedar Rapids and Hiawatha.
- Consider installing additional ATR site(s) in the s-curve area to monitor traffic volume and speed in that location.
- Install additional curve warning signing with flashing beacons, preferably overhead, on either side of the s-curve area to better warn drivers of the alignment of I-380 in that area.
- Review safe operating speeds through the s-curve area to ascertain whether the posted speed limit is appropriate. (The design speed is 60 mph.). Smooth tire friction testing could be included in this review.
- Review the intersection at the 1st Street NW terminus for needed improvements in sign and marking visibility. Relocate roadway lamps and replace guide signs to improve the visibility of these devices.
- Enhance pavement markings in the larger gore areas, especially at the interchanges north of the central business area. Consider adding chevron markings or surface treatments with highly visible retro-reflective coating to enhance visibility.

Longer Term, Higher Cost Options

- Study acquisition and removal of the large building along northbound I-380 just south of the 1st Street NW off-ramp. This building was damaged by the flooding of the Cedar River in the summer of 2008, and acquisition costs should be reduced.
- Consider installation of an ice detection system on the 5 in 1 Bridge, with appropriate warning provided to approaching drivers using the existing CMS devices. This warning messaging could be automated to avoid confusion of responsibilities for implementing the warning by Iowa DOT and/or city staff. Consider installation of additional CMS devices on each side of the s-curve to advise drivers of pavement surface conditions, crashes, delays, etc.
- Study the 1st Avenue west termini for long-term improvement, considering such options as
    - closing the L Street connection,
    - combining L Street and the off-ramp at some distance from the 1st Avenue intersection, and
    - adding arrow signals for each southbound lane south of 1st Avenue with "only" signs to improve driver understanding of operational intent. Overhead signals currently have arrow signal indications, but the far left signal has a green ball.

- Study the implementation of automated enforcement in this corridor, both traffic signal and speed enforcement. These programs have proven highly effective in several cities in Iowa and other states for improving driver compliance with traffic laws. This program would be especially effective in the s-curve area and Collins Road intersection, where surveillance and apprehension is very difficult due to roadway conditions.

- The City of Cedar Rapids and the Iowa DOT should work together to install a system of observation cameras along key locations of the I-380 corridor to monitor traffic conditions and improve response time for identified incidents and crashes.
- Consider corrective action for low-friction areas when warranted, including diamond milling and placement of high-friction treatment such as “Italgrip” or similar proprietary products, especially in the s-curves area.
- Study and take appropriate action on replacing of the cantilever guide sign assembly for southbound traffic south of the 33rd Avenue SW interchange with a full truss and guide signs for each lane of travel.
- Pending the results of a more detailed crash study, consider retro-fitting the existing bridge rail with a concrete barrier rail to prevent penetration by large commercial vehicles on the Cedar River (5 in 1) bridge as well as on the SB to EB ramp bridge at the I-380/US 30 interchange.
- Move forward with construction of the IA 100 bypass, which may reduce traffic volumes on I-380 near the central business district.

APPENDIX A. SPEED DATA

Table A.1. Speed data for 1-380 South of Coldstream Ave. (ATR #703), August 13–31, 2008

	# of vehicles	AVG SPEED
NBinside	154,145	66.0
NBCinside	292,567	64.9
NBCoutside	315,599	61.5
NBoutside	38,298	55.8
NB TOTAL	800,609	**63.3**
SBinside	172,778	65.3
SBCinside	317,355	60.8
SBCoutside	247,149	61.0
SBoutside	55,356	60.5
SB TOTAL	792,638	**61.9**
ALL minus 2 outside lanes	1,499,593	62.8
ALL	1,593,247	**62.6**

MATERIALS DE. ..TMENT 11:07 Monday, July 7, 20.. 3
PAVEMENT FRICTION TESTS
Program S4164115

County: Linn(57) Highway: I- 380 Begin Milepost: 19.00 End Milepost: 21.30 Direction: N

Lane: 3 Pavement Type: PC Date Tested: 06-10-08 Friction Trailer: Lab. No.: FR8-0005

Year Built: Est. Mileage: 2.30 Project No.: Pavement Friction
Engineering Bureau
District 6

MPH: 40 Wheel Track: I Special Test Indicator:

MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr
019.000		51																					
019.300		43																					
019.500		47																					
019.750		46																					
020.000		51																					
020.250		50																					
020.500		44																					
020.750		40																					
021.000		44																					
021.250		48																					

A = Asphaltic Cement Concrete Pavement Section
P = Portland Cement Concrete Pavement Section
Q = Tested at Quarter Point
O = Oily Spot on Pavement

* * * SUMMARY STATISTICS * * *

	MEAN	S.E.	STD.DEV.	MAX.	MIN.
NORTHBOUND	46 +/- 1		4	51	40
SOUTHBOUND	+/-				
COMBINED	46 +/- 1		4	51	40

NOTE: A, P, Q, and O tests are not included in summary statistics.

REMARKS: LANE 3 IS THE INSIDE LANE
MP 19.0-19.44 PROJ.# I-380-60(45) BUILT IN 1976
MP 19.43-22.37 PROJ.# I-IG-380-6(124) BUILT IN 1981

ACTION REQUIRED:

No action required

HISTORY

MILEPOST BEGIN	MILEPOST END	NORTHBOUND TEST DATE	NORTHBOUND FRICTION AVG	NORTHBOUND FRICTION MAX	NORTHBOUND FRICTION MIN	SOUTHBOUND TEST DATE	SOUTHBOUND FRICTION AVG	SOUTHBOUND FRICTION MAX	SOUTHBOUND FRICTION MIN

FORM DEY

MATERIALS DEPARTMENT
PAVEMENT FRICTION TESTS
Program S4164115

County: Linn(57) Highway: I- 380 Begin Milepost: 19.00 End Milepost: 21.30 Direction: S

Lane: 1 Pavement Type: PC Date Tested: 06-10-08 Friction Trailer: Lab. No.: FR8-0002

Year Built: Est. Mileage: 2.30 Project No.: Pavement Friction Engineering Bureau

MPH: 40 Wheel Track: I Special Test Indicator: District 6

MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr
019.000		32																					
019.300		43																					
019.500		43																					
019.750		35																					
020.000		38																					
020.250		36																					
020.500		39																					
020.750		32																					
021.000		34																					
021.250		38																					

A = Asphaltic Cement Concrete Pavement Section
P = Portland Cement Concrete Pavement Section
Q = Tested at Quarter Point
O = Oily Spot on Pavement

* * * SUMMARY STATISTICS * * *

	MEAN	+/-	S.E.	STD.DEV.	MAX.	MIN.
NORTHBOUND						
SOUTHBOUND	37	+/- 1		4	43	32
COMBINED	37	+/- 1		4	43	32

NOTE: A, P, Q, and O tests are not included in summary statistics.

HISTORY

MILEPOST BEGIN	MILEPOST END	NORTHBOUND TEST DATE	NORTHBOUND FRICTION AVG	NORTHBOUND FRICTION MAX	NORTHBOUND FRICTION MIN	SOUTHBOUND TEST DATE	SOUTHBOUND FRICTION AVG	SOUTHBOUND FRICTION MAX	SOUTHBOUND FRICTION MIN

REMARKS: LANE 1 IS THE OUTSIDE LANE
MP 19.0-19.44 PROJ.# I-380-60(45) BUILT IN 1976
MP 19.43-22.37 PROJ.# I-IG-380-6(124) BUILT IN 1981

ACTION REQUIRED:

To Friction Review Committee

FORM GREY

MATERIALS DE. .RTMENT
PAVEMENT FRICTION TESTS
Program S4164115

11:07 Monday, July 7, 20.. 5

County: Linn(57) Highway: I- 380 Begin Milepost: 19.00 End Milepost: 21.30 Direction: S

Lane: 2 Pavement Type: PC Date Tested: 06-10-08 Friction Trailer: Lab. No.: FR8-0004

Year Built: Est. Mileage: 2.30 Project No.:

Pavement Friction
Engineering Bureau
District 6

MPH: 40 Wheel Track: I Special Test Indicator:

MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr
019.000		40																					
019.300		44																					
019.500		41																					
019.750		31																					
020.000		35																					
020.250		38																					
020.500		38																					
020.750		37																					
021.000		34																					
021.250		39																					

A = Asphaltic Cement Concrete Pavement Section
P = Portland Cement Concrete Pavement Section

Q = Tested at Quarter Point
O = Oily Spot on Pavement

* * * SUMMARY STATISTICS * * *

	MEAN +/-	S.E.	STD.DEV.	MAX.	MIN.
NORTHBOUND					
SOUTHBOUND	38 +/- 1		4	44	31
COMBINED	38 +/- 1		4	44	31

NOTE: A, P, Q, and O tests are not included in summary statistics.

HISTORY

MILEPOST BEGIN	MILEPOST END	TEST DATE	NORTHBOUND FRICTION AVG	NORTHBOUND FRICTION MAX	NORTHBOUND FRICTION MIN	TEST DATE	SOUTHBOUND FRICTION AVG	SOUTHBOUND FRICTION MAX	SOUTHBOUND FRICTION MIN

REMARKS: LANE 2 IS THE MIDDLE LANE
MP 19.0-19.44 PROJ.# I-380-60(45) BUILT IN 1976
MP 19.43-22.37 PROJ.# I-IG-380-6(124) BUILT IN 1981

ACTION REQUIRED:

No action required

FORM GBEY

MATERIALS DEPARTMENT
PAVEMENT FRICTION TESTS
Program S4164115

11:07 Monday, July 7, 2008 6

County: Linn(57) Highway: I- 380 Begin Milepost: 19.00 End Milepost: 21.30 Direction: S

Lane: 3 Pavement Type: PC Date Tested: 06-10-08 Friction Trailer: Lab. No.: FR8-0006

Year Built: Est. Mileage: 2.30 Project No.:

Pavement Friction
Engineering Bureau
District 6

MPH: 40 Wheel Track: I Special Test Indicator:

MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr
019.000			50																				
019.300			44																				
019.500			47																				
019.750			44																				
020.600			44																				
020.750			46																				
021.000			44																				
021.250			47																				

A = Asphaltic Cement Concrete Pavement Section
P = Portland Cement Concrete Pavement Section
Q = Tested at Quarter Point
O = Oily Spot on Pavement

* * * SUMMARY STATISTICS * * *

	MEAN	S.E. +/-	STD.DEV.	MAX.	MIN.
NORTHBOUND					
SOUTHBOUND	46	+/- .8	2	50	44
COMBINED	46	+/- .8	2	50	44

NOTE: A, P, Q, and O tests are not included in summary statistics.

REMARKS: LANE 3 IS INSIDE LANE,CLOSED BETWEEN MP 19.7-20.6
MP 19.0-19.44 PROJ.# I-380-60(45) BUILT IN 1976
MP 19.43-22.37 PROJ.# I-IG-380-6(124) BUILT IN 1981

ACTION REQUIRED:

No action required

HISTORY

MILEPOST BEGIN	MILEPOST END	NORTHBOUND TEST DATE	NORTHBOUND FRICTION AVG	NORTHBOUND FRICTION MAX	NORTHBOUND FRICTION MIN	SOUTHBOUND TEST DATE	SOUTHBOUND FRICTION AVG	SOUTHBOUND FRICTION MAX	SOUTHBOUND FRICTION MIN

FORM 0467

MATERIALS DEPARTMENT
PAVEMENT FRICTION TESTS
Program S4164115

11:07 Monday, July 7, 20[illegible] 1

County: Linn(57) Highway: I- 380 Begin Milepost: 19.00 End Milepost: 21.30 Direction: N

Lane: 1 Pavement Type: PC Date Tested: 06-10-08 Friction Trailer: Lab. No.: FR8*0001

Year Built: Est. Mileage: 2.30 Project No.:

Pavement Friction
Engineering Bureau
District 6

MPH: 40 Wheel Track: I Special Test Indicator:

MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr
019.000		35																					
019.300		38																					
019.500		40																					
019.750		37																					
020.000		44																					
020.250		37																					
020.500		38																					
020.750		36																					
021.000		33																					
021.250		36																					

A = Asphaltic Cement Concrete Pavement Section
P = Portland Cement Concrete Pavement Section
Q = Tested at Quarter Point
O = Oily Spot on Pavement

* * * SUMMARY STATISTICS * * *

	MEAN	S.E.	STD.DEV.	MAX.	MIN.
NORTHBOUND	37 +/-.9		3	44	33
SOUTHBOUND	+/-				
COMBINED	37 +/-.9		9	44	33

NOTE: A, P, Q, and O tests are not included in summary statistics.

REMARKS: LANE 1 IS THE OUTSIDE LANE
MP 19.0-19.44 PROJ.# I-380-60(45) BUILT IN 1976
MP 19.43-22.37 PROJ.# I-IG-380-6(124) BUILT IN 1981

ACTION REQUIRED:

To Friction Review Committee

HISTORY

MILEPOST BEGIN	MILEPOST END	TEST DATE	NORTHBOUND FRICTION AVG	NORTHBOUND FRICTION MAX	NORTHBOUND FRICTION MIN	TEST DATE	SOUTHBOUND FRICTION AVG	SOUTHBOUND FRICTION MAX	SOUTHBOUND FRICTION MIN

FORM DEEV

MATERIALS DEPARTMENT
PAVEMENT FRICTION TESTS
Program S4164115

11:07 Monday, July 7, 2008 2

County: Linn(57) Highway: I- 380 Begin Milepost: 19.00 End Milepost: 21.30 Direction: N

Lane: 2 Pavement Type: PC Date Tested: 06-10-08 Friction Trailer: Lab. No.: FR8-0003

Year Built: Est. Mileage: 2.30 Project No.:

Pavement Friction
Engineering Bureau
District 6

MPH: 40 Wheel Track: I Special Test Indicator:

MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr	MILE-POST	R E M	NB Fr	SB Fr
019.000		39																					
019.300		34																					
019.500		36																					
019.750		31																					
020.000		37																					
020.250		35																					
020.500		34																					
020.750		33																					
021.000		31																					
021.250		37																					

A = Asphaltic Cement Concrete Pavement Section
P = Portland Cement Concrete Pavement Section
Q = Tested at Quarter Point
O = Oily Spot on Pavement

* * * SUMMARY STATISTICS * * *

	MEAN	S.E.	STD.DEV.	MAX.	MIN.
NORTHBOUND	35	+/-.8	3	39	31
SOUTHBOUND		+/-			
COMBINED	35	+/-.8	3	39	31

NOTE: A, P, Q, and O tests are not included in summary statistics.

REMARKS: LANE 2 IS THE MIDDLE LANE
MP 19.0-19.44 PROJ.# I-380-60(45) BUILT IN 1976
MP 19.43-22.37 PROJ.# I-IG-380-6(124) BUILT IN 1981

ACTION REQUIRED:

To Friction Review Committee

HISTORY

MILEPOST BEGIN	MILEPOST END	NORTHBOUND TEST DATE	NORTHBOUND FRICTION AVG	NORTHBOUND FRICTION MAX	NORTHBOUND FRICTION MIN	SOUTHBOUND TEST DATE	SOUTHBOUND FRICTION AVG	SOUTHBOUND FRICTION MAX	SOUTHBOUND FRICTION MIN

FORM C6EV

APPENDIX C. CRASH DATA FOR I-380

Table C.1. Crashes on I-380 mainline by major cause, 2001–2007

Major Cause	Crashes						Injuries						Uninjured
	Total	Fatal	Major	Minor	Possible	PDO	Total	Fatalities	Major	Minor	Possible	Unknown	
Animal	26		1	1	1	23	5		2	1	2		16
Ran Traffic Signal	24		2	3	6	13	19		2	8	9		32
Ran Stop Sign													
Crossed centerline	14		2	1	1	10	7		2	1	4		13
FTYROW: At uncontrolled intersection	3			1		2	2			2			4
FTYROW: Making right turn on red signal													
FTYROW: From stop sign	2			1		1	1			1			4
FTYROW: From yield sign	2		1			1	2		1	1			2
FTYROW: Making left turn	8				1	7	1				1		9
FTYROW: From driveway													
FTYROW: From parked position	2					2							1
FTYROW: To pedestrian													
FTYROW: Other (explain in narrative)	44			6	9	29	29			12	15	2	40
Traveling wrong way or on wrong side of road	3	2		1			8	5		3			3
Driving too fast for conditions	57		1	9	16	31	34		1	12	21		64
Exceeded authorized speed	9	1	1	1	3	3	13	1	5	3	3	1	6
Made improper turn	12		1		2	9	4		1		3		14
Improper Lane Change													
Followed too close	45			10	8	27	28			13	15		77
Disregarded RR Signal													
Disregarded Warning Sign													
Operating vehicle in an erratic/...negligent/aggressive manner	11		1	1	2	7	5		1	2	2		14
Improper Backing													
Illegally Parked/Unattended													
Swerving/Evasive Action	91		1	13	28	49	45		1	13	29	2	112
Over correcting/over steering	11		1	2	4	4	7		1	2	4		7
Downhill runaway	2					2							1
Equipment failure	6					6							9
Separation of units													
Ran off road - right	45		2	9	11	23	23		2	9	11	1	40
Ran off road - straight	1					1							1
Ran off road - left	22	2	1	1	7	11	14	4	1	2	7		15
Lost Control	82	1	4	7	9	61	31	1	6	12	10	2	104
Inattentive/distracted by: Passenger	2			1		1	1			1			2
Inattentive/distracted by: Use of phone or other device	2				1	1	1				1		3
Inattentive/distracted by: Fallen object	4			1		3	1			1			3
Inattentive/distracted by: Fatigued/asleep	3			1	1	1	2			1	1		2
Other (explain in narrative): Vision obstructed	8			2	2	4	7			4	2	1	5
Oversized Load/Vehicle													
Cargo/equipment loss or shift	2					2							3
Other (explain in narrative): Other improper action	32			3	9	20	14			4	10		52
Unknown	133			8	24	101	40			9	30	1	205
Other (explain in narrative): No improper action	96	1	2	13	18	62	41	1	2	14	21	3	127
None indicated	43			3	5	35	9			3	4	2	64
Totals[1]:	847	7	21	99	168	552	394	12	28	134	205	15	1054

Table C.2. Crashes on I-380 southbound by major cause, 2001–2007

Major Cause	Crashes						Injuries						Uninjured
	Total	Fatal	Major	Minor	Possible	PDO	Total	Fatalities	Major	Minor	Possible	Unknown	
Animal	4		1			3	2		2				4
Ran Traffic Signal	4		1		1	2	4		1	2	1		7
Ran Stop Sign													
Crossed centerline	6		2	1		3	4		2	1	1		8
FTYROW: At uncontrolled intersection	1			1			2			2			
FTYROW: Making right turn on red signal													
FTYROW: From stop sign													
FTYROW: From yield sign													
FTYROW: Making left turn	1					1							2
FTYROW: From driveway													
FTYROW: From parked position													
FTYROW: To pedestrian													
FTYROW: Other (explain in narrative)	10				2	8	5				5		17
Traveling wrong way or on wrong side of road	2	2					7	5		2			3
Driving too fast for conditions	31			5	10	16	21			8	13		34
Exceeded authorized speed	2	1			1		8	1	4	1	1	1	1
Made improper turn	3		1			2	1		1				4
Improper Lane Change													
Followed too close	9			2	1	6	9			5	4		28
Disregarded RR Signal													
Disregarded Warning Sign													
Operating vehicle in an erratic/reckless/careless/negligent/aggressive manner	3		1			2	1		1				3
Improper Backing													
Illegally Parked/Unattended													
Swerving/Evasive Action	31			8	14	9	24			8	14	2	35
Over correcting/over steering	3			1	1	1	2			1	1		2
Downhill runaway	1					1							1
Equipment failure	5					5							6
Separation of units													
Ran off road - right	22		2	4	5	11	12		2	4	6		18
Ran off road - straight													
Ran off road - left	8	1		1	2	4	7	3		2	2		9
Lost Control	27		3	2	3	19	12		5	3	3	1	34
Inattentive/distracted by: Passenger	1					1							2
Inattentive/distracted by: Use of phone or other device													
Inattentive/distracted by: Fallen object	1					1							
Inattentive/distracted by: Fatigued/asleep													
Other (explain in narrative): Vision obstructed													
Oversized Load/Vehicle													
Cargo/equipment loss or shift													
Other (explain in narrative): Other improper action	10			1	2	7	5			2	3		18
Unknown	6			1	2	3	3			1	2		14
Other (explain in narrative): No improper action	11	1		2	4	4	11	1		2	7	1	21
None indicated	1					1							2
Totals[1]:	203	5	11	29	48	110	140	10	18	44	63	5	273

Table C.3. Crashes on I-380 northbound by major cause, 2001–2007

Major Cause	Crashes						Injuries						Uninjured
	Total	Fatal	Major	Minor	Possible	PDO	Total	Fatalities	Major	Minor	Possible	Unknown	
Animal	6			1		5	1			1			4
Ran Traffic Signal	14		1	2	4	7	12		1	5	6		14
Ran Stop Sign													
Crossed centerline	5		2	1	1	1	7		2	1	4		3
FTYROW: At uncontrolled intersection													
FTYROW: Making right turn on red signal													
FTYROW: From stop sign													
FTYROW: From yield sign													
FTYROW: Making left turn	1					1							2
FTYROW: From driveway													
FTYROW: From parked position													
FTYROW: To pedestrian													
FTYROW: Other (explain in narrative)	6			2	1	3	4			2	2		8
Traveling wrong way or on wrong side of road	2	1		1			4	1		3			2
Driving too fast for conditions	15		1	4	3	7	12		1	5	6		13
Exceeded authorized speed	6	1	1	1	1	2	11	1	5	3	1	1	5
Made improper turn													
Improper Lane Change													
Followed too close	13			3	3	7	9			3	6		20
Disregarded RR Signal													
Disregarded Warning Sign													
Operating vehicle in an erratic/reckless/careless/negligent/aggressive manner	2			1	1		3			2	1		2
Improper Backing													
Illegally Parked/Unattended													
Swerving/Evasive Action	16		1	2	4	9	8		1	2	5		21
Over correcting/over steering	2		1		1		2		1		1		
Downhill runaway	1					1							
Equipment failure	1					1							3
Separation of units													
Ran off road - right	18			5	3	10	8			5	3		18
Ran off road - straight	1					1							1
Ran off road - left	13	2	1	1	5	4	12	4	1	2	5		3
Lost Control	39	1	1	5	5	27	18	1	1	9	6	1	55
Inattentive/distracted by: Passenger													
Inattentive/distracted by: Use of phone or other device													
Inattentive/distracted by: Fallen object													
Inattentive/distracted by: Fatigued/asleep	2			1	1		2			1	1		
Other (explain in narrative): Vision obstructed	1					1							2
Oversized Load/Vehicle													
Cargo/equipment loss or shift	2					2							3
Other (explain in narrative): Other improper action	12			2	4	6	7			3	4		18
Unknown	7				4	3	4				3	1	11
Other (explain in narrative): No improper action	9		1	1	5	2	8		1	1	6		11
None indicated													
Totals[1]:	194	5	10	33	46	100	132	7	14	48	60	3	219

Table C.4. Crashes on I-380 mainline by manner of crash/collision, 2001–2007

Manner of Crash/Collision	Crashes						Injuries						Uninjured
	Total	Fatal	Major	Minor	Possible	PDO	Total	Fatalities	Major	Minor	Possible	Unknown	
Non-collision	217	3	7	28	44	135	88	3	9	29	44	3	133
Head-on	22	3	1	3		15	20	5	5	8	1	1	31
Rear-end	287		4	41	71	171	169		5	60	98	6	428
Angle - oncoming left turn	25		2		4	19	9		2	2	4	1	31
Broadside	40	1	2	7	8	22	28	4	2	10	12		50
Sideswipe - same direction	193		3	14	29	147	51		3	16	30	2	285
Sideswipe - opposite direction	8		1	1	2	4	6		1	2	3		10
Unknown	17		1	2	3	11	11		1	4	4	2	19
Not Reported	38			3	7	28	12			3	9		67
Totals[1]:	847	7	21	99	168	552	394	12	28	134	205	15	1054

Table C.5. Crashes on I-380 southbound by manner of crash/collision, 2001–2007

Manner of Crash/Collision	Crashes						Injuries						Uninjured
	Total	Fatal	Major	Minor	Possible	PDO	Total	Fatalities	Major	Minor	Possible	Unknown	
Non-collision	74	1	5	12	14	42	36	1	7	13	15		48
Head-on	8	3	1	3		1	20	5	5	8	1	1	6
Rear-end	64		1	9	22	32	54		2	15	33	4	125
Angle - oncoming left turn	3		2			1	4		2	2			2
Broadside	7	1		2	1	3	7	4		2	1		12
Sideswipe - same direction	41		1	2	9	29	12		1	2	9		73
Sideswipe - opposite direction	4		1	1	1	1	5		1	2	2		5
Unknown	2				1	1	2				2		2
Not Reported													
Totals[1]:	203	5	11	29	48	110	140	10	18	44	63	5	273

Table C.6. Crashes on I-380 northbound by manner of crash/collision, 2001–2007

Manner of Crash/Collision	Crashes						Injuries						Uninjured
	Total	Fatal	Major	Minor	Possible	PDO	Total	Fatalities	Major	Minor	Possible	Unknown	
Non-collision	67	2	2	10	22	31	38	2	2	10	22	2	34
Head-on	10	3	1	3		3	20	5	5	8	1	1	10
Rear-end	55		2	10	12	31	34		2	13	19		87
Angle - oncoming left turn	3				1	2	2				2		4
Broadside	14		2	2	3	7	12		2	5	5		14
Sideswipe - same direction	37		1	6	6	24	16		1	8	7		64
Sideswipe - opposite direction	3		1	1	1		5		1	2	2		1
Unknown	5		1	1	1	2	5		1	2	2		5
Not Reported													
Totals[1]:	194	5	10	33	46	100	132	7	14	48	60	3	219

Table C.7. Crashes on I-380 mainline by time of day and day of week, 2001–2007

Time of day	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
Not Reported		1		1		1		3
00:00-01:59	5	2	5	5		4	4	25
02:00-03:59	2	2	5	1	5	9	3	27
04:00-05:59	3	5	2	2	9	6	4	31
06:00-07:59	2	23	18	31	27	18	6	124
08:00-09:59	5	19	14	6	19	20	13	96
10:00-11:59	10	13	15	9	13	8	6	74
12:00-13:59	16	15	10	9	12	19	12	93
14:00-15:59	5	14	27	16	13	15	16	106
16:00-17:59	11	13	13	21	18	28	13	117
18:00-19:59	8	8	10	7	8	11	7	59
20:00-21:59	4	13	9	11	7	7	4	55
22:00-23:59		5	7	5	6	8	6	37
Grand Total	71	133	135	124	137	154	93	847

Table C.8. Crashes on I-380 mainline by day of week and crash severity, 2001–2007

	Crashes						Injuries						
Day of Week	Total	Fatal	Major	Minor	Possible	PDO	Total	Fatalities	Major	Minor	Possible	Unknown	Uninjured
Sunday	71	1	1	8	8	53	21	1	1	8	11		79
Monday	133		6	13	29	85	64		6	21	31	6	162
Tuesday	135	1	2	17	31	84	70	1	2	26	40	1	164
Wednesday	124	2	3	16	24	79	55	2	5	19	29		141
Thursday	137	1	1	16	32	87	67	4	1	18	42	2	185
Friday	154	1	5	19	24	105	59	3	5	22	25	4	200
Saturday	93	1	3	10	20	59	58	1	8	20	27	2	123
Totals[1]:	847	7	21	99	168	552	394	12	28	134	205	15	1054

Table C.9. Crashes on I-380 mainline by month and crash severity, 2001–2007

Month	Crashes						Injuries						
	Total	Fatal	Major	Minor	Possible	PDO	Total	Fatalities	Major	Minor	Possible	Unknown	Uninjured
January	113	1	1	9	26	76	46	1	1	12	27	5	151
February	89	1	1	11	17	59	35	1	1	15	17	1	119
March	49		3	4	8	34	18		3	6	9		64
April	59	1		7	9	42	29	1	4	8	14	2	75
May	58		1	5	13	39	23		1	6	15	1	68
June	41		1	6	8	26	20		1	9	10		48
July	46		1	4	11	30	19		1	7	11		61
August	71		4	8	13	46	34		7	9	18		91
September	56	2	2	7	8	37	25	2	2	11	8	2	63
October	76		3	12	17	44	50		3	21	26		96
November	78	1	2	11	13	51	39	3	2	13	18	3	73
December	111	1	2	15	25	68	56	4	2	17	32	1	145
Not Reported													
Totals[1]:	847	7	21	99	168	552	394	12	28	134	205	15	1054

Table C.10. Crashes on I-380 mainline by light conditions, 2001–2007

Light Conditions	Crashes						Injuries						
	Total	Fatal	Major	Minor	Possible	PDO	Total	Fatalities	Major	Minor	Possible	Unknown	Uninjured
Daylight	524	2	15	64	104	339	242	2	17	84	128	11	677
Dusk	12				3	9	3				2	1	13
Dawn	27		1	6	2	18	16		1	11	3	1	28
Dark - roadway lighted	160	2	4	22	36	96	82	5	4	30	42	1	175
Dark - roadway not lighted	48	3	1	4	11	29	33	5	6	6	15	1	45
Dark - unknown roadway lighting	14				4	10	4				4		18
Unknown	2					2							1
Not Reported	60			3	8	49	14			3	11		97
Totals[1]:	847	7	21	99	168	552	394	12	28	134	205	15	1054

Table C.11. Crashes on I-380 mainline by driver condition, 2001–2007

Driver Condition	Crashes						Injuries						
	Total	Fatal	Major	Minor	Possible	PDO	Total	Fatalities	Major	Minor	Possible	Unknown	Uninjured
Apparently normal	690	3	19	85	144	439	342	3	26	120	180	13	865
Physical impairment	5			1	2	2	5			1	4		7
Emotional (e.g. depressed/angry/disturbed)	9		1	3	1	4	8		1	6	1		5
Illness	2			1	1	1	2			1	1		1
Asleep/fainted/fatigued/etc.	10		1	2	2	5	6		1	2	3		6
Under the influence of alcohol/drugs/medications	50	1	3	7	7	32	23	4	3	8	8		45
Other (explain in narrative)	14			2	4	8	6			2	2	2	10
Unknown	29	6	1		10	12	34	11	5	3	11	4	33
Not Reported	250		1	20	35	194	71		1	23	42	5	358
Totals[1]:	1059	10	26	121	206	697	497	18	37	166	252	24	1330

Table C.12. Crashes on I-380 mainline by driver age, 2001–2007

Driver Age	Crashes						Injuries						Unknown
	Total	Fatal	Major	Minor	Possible	PDO	Total	Fatalities	Major	Minor	Possible	Uninjured	
0-13													
14													
15-24	457	3	14	56	98	286	246	9	20	84	127	6	530
25-34	345	2	7	45	80	211	188	2	11	65	102	8	489
35-44	288	5	6	33	64	180	152	7	6	49	83	7	217
45-54	256	3	6	28	49	170	132	3	9	54	59	7	395
55-64	121			13	18	90	44			20	23	1	163
65-74	65	1	3	9	9	43	31	3	3	9	16		95
75-84	14			2	2	10	4			2	1	1	19
85-94	5					5							8
95-98+													
Unknown	61		2	5	11	43	22		2	6	11	3	90
Totals	**1612**	**14**	**38**	**191**	**331**	**1038**	**819**	**24**	**51**	**289**	**422**	**33**	**2006**

Table C.13. Crashes on I-380 mainline by weather conditions, 2001–2007

Weather Conditions	Crashes						Injuries						Uninjured
	Total	Fatal	Major	Minor	Possible	PDO	Total	Fatalities	Major	Minor	Possible	Unknown	
Clear	363	1	13	48	71	230	175	3	13	67	89	3	442
Partly cloudy	114	1	3	14	24	72	57	1	6	20	28	2	118
Cloudy	74	3	2	11	11	47	43	6	6	13	14	4	92
Fog/smoke	4		1			3	1		1				6
Mist	15			2	5	8	8			3	4	1	12
Rain	72	1		7	19	45	39	1		10	28		96
Sleet/hail/freezing rain	24				6	18	7				6	1	29
Snow	110	1	2	13	24	70	49	1	2	17	25	4	145
Severe winds	1					1							2
Blowing sand/soil/dirt/snow	5			1		4	1			1			10
Other (explain in narrative)	2					2							4
Unknown	5					5							6
Not Reported	58			3	8	47	14			3	11		92
Totals[1]:	847	7	21	99	168	552	394	12	28	134	205	15	1054

Table C.14. Crashes on I-380 mainline by surface conditions, 2001–2007

Surface Conditions	Crashes						Injuries						Uninjured
	Total	Fatal	Major	Minor	Possible	PDO	Total	Fatalities	Major	Minor	Possible	Unknown	
Dry	493	5	16	61	93	318	242	10	23	83	118	8	595
Wet	114	1	3	18	30	62	70	1	3	27	36	3	143
Ice	74			7	14	53	23			7	16		100
Snow	73	1	2	7	14	49	32	1	2	11	15	3	94
Slush	16				7	9	8				7	1	20
Sand/mud/dirt/oil/gravel	1					1							2
Water (standing/moving)	2					2							1
Other (explain in narrative)	1				1		1				1		
Unknown	3					3							2
Not Reported	70			6	9	55	18			6	12		97
Totals[1]:	847	7	21	99	168	552	394	12	28	134	205	15	1054

Table C.15. Fixed object crashes on I-380 mainline by first harmful event, 2001–2007

First Harmful Event	Fixed Object Struck	Total
Overturn/Rollover	Culvert	1
	Ditch/embankment	1
	Other fixed object (explain in narrative)	2
	Sign post	1
Overturn/Rollover Total		5
Other non-collision (explain in narrative)	Bridge/bridge rail/overpass	3
Other non-collision (explain in narrative) Total		3
Collision with vehicle in traffic	Bridge/bridge rail/overpass	1
	Guardrail	2
Collision with vehicle in traffic Total		3
Collision with Bridge/bridge rail/overpass	Bridge/bridge rail/overpass	8
	Multiple	1
Bridge/bridge rail/overpass Total		9
Collision with Underpass/structure support	Underpass/structure support	2
Underpass/structure support Total		2
Collision with Ditch/embankment	Ditch/embankment	5
Ditch/embankment Total		5
Collision with Curb/island/raised median	Multiple	2
Curb/island/raised median Total		2
Collision with: Guardrail	Guardrail	22
	Multiple	1
Guardrail Total		23
Collision with Concrete Barrier	Concrete barrier (median or right side)	5
Concrete Barrier Total		5
Collision with: Tree	Tree	1
Tree Total		1
Collision with Poles	Multiple	1
	Poles (utility, light, etc.)	5
Poles Total		6
Collision with Sign post	Multiple	2
Sign post Total		2
Collision with Other fixed object (explain in narrative)	Multiple	3
	Other fixed object (explain in narrative)	1
Collision with Other fixed object (explain in narrative) Total		4
Grand Total Fixed Object Collisions		70

Table C.16. Fixed object crashes on I-380 mainline by crash severity, 2001–2007

Crash Severity	Fixed Object Struck	Total
Fatal	Bridge/bridge rail/overpass	1
	Fatal Total	1
Major	Bridge/bridge rail/overpass	1
	Concrete barrier (median or right side)	1
	Underpass/structure support	1
	Major Total	3
Minor	Bridge/bridge rail/overpass	1
	Concrete barrier (median or right side)	2
	Culvert	1
	Guardrail	4
	Multiple	1
	Poles (utility, light, etc.)	1
	Minor Total	10
Possible/Unknown	Bridge/bridge rail/overpass	5
	Concrete barrier (median or right side)	2
	Ditch/embankment	2
	Guardrail	2
	Multiple	4
	Other fixed object (explain in narrative)	1
	Poles (utility, light, etc.)	1
	Sign post	1
	Tree	1
	Underpass/structure support	1
	Possible/Unknown Total	20
Property Damage Only	Bridge/bridge rail/overpass	4
	Ditch/embankment	4
	Guardrail	18
	Multiple	5
	Other fixed object (explain in narrative)	2
	Poles (utility, light, etc.)	3
	Property Damage Only Total	36
Grand Total		70

Table C.17. Fixed object crashes on I-380 mainline by month, 2001–2007

Month	Fixed Object	Total	Monthly Total
Jan.	Bridge/bridge rail/overpass	1	11
	Ditch/embankment	1	
	Guardrail	5	
	Multiple	2	
	Other fixed object (explain in narrative)	2	
Feb.	Culvert	1	5
	Ditch/embankment	2	
	Guardrail	1	
	Multiple	1	
March	Bridge/bridge rail/overpass	2	4
	Guardrail	1	
	Multiple	1	
April	Ditch/embankment	1	4
	Guardrail	3	
May	Bridge/bridge rail/overpass	1	6
	Concrete barrier (median or right side)	1	
	Guardrail	3	
	Poles (utility, light, etc.)	1	
June	Poles (utility, light, etc.)	1	2
	Tree	1	
July	Bridge/bridge rail/overpass	2	4
	Guardrail	1	
	Multiple	1	
Aug.	Bridge/bridge rail/overpass	1	4
	Guardrail	2	
	Other fixed object (explain in narrative)	1	
Sept.	Bridge/bridge rail/overpass	2	5
	Guardrail	2	
	Multiple	1	
Oct.	Bridge/bridge rail/overpass	2	8
	Concrete barrier (median or right side)	2	
	Guardrail	2	
	Multiple	1	
	Poles (utility, light, etc.)	1	
Nov.	Bridge/bridge rail/overpass	1	9
	Concrete barrier (median or right side)	1	
	Ditch/embankment	2	
	Guardrail	3	
	Multiple	1	
	Sign post	1	
Dec.	Concrete barrier (median or right side)	1	8
	Guardrail	1	
	Multiple	2	
	Poles (utility, light, etc.)	2	
	Underpass/structure support	2	
Grand Total		70	

Table C.18. Crashes at interchange of I-380 and Wright Brothers Blvd., west terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	0	0	2	2
	Injuries	0	0	0	0/0		0
2002	Crashes	0	0	0	0	0	0
	Injuries	0	0	0	0/0		0
2003	Crashes	0	0	0	0	3	3
	Injuries	0	0	0	0/0		0
2004	Crashes	0	0	0	2	1	3
	Injuries	0	0	0	2/0		2
2005	Crashes	0	0	1	0	1	1
	Injuries	0	0	1	0/0		0
2006	Crashes	0	0	0	0	4	4
	Injuries	0	0	0	0/0		0
2007	Crashes	0	0	2	0	2	4
	Injuries	0	0	2	1/0		5
Seven-year summary, 2001 through 2007							
	Crashes	0	0	3	2	13	17
	Injuries	0	0	3	3		7

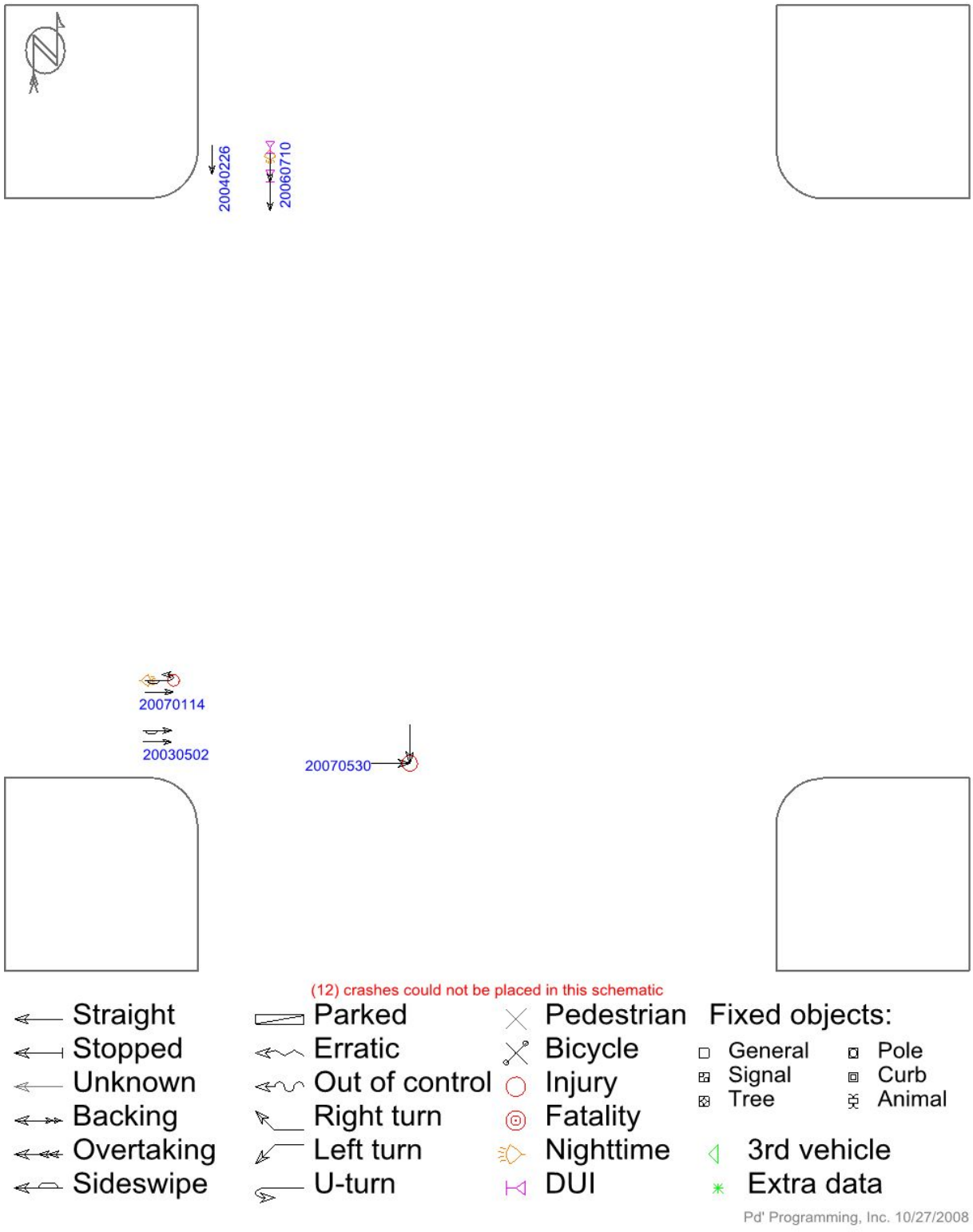

Figure C.1. Crash diagram for west terminal I-380 and Wright Brothers Blvd., 2001–2007

Table C.19. Crashes at interchange of I-380 and Wright Brothers Blvd., east terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	0	0	2	2
	Injuries	0	0	0	0/0		0
2002	Crashes	0	0	0	0	3	3
	Injuries	0	0	0	0/0		0
2003	Crashes	0	0	0	0	3	3
	Injuries	0	0	0	0/0		0
2004	Crashes	0	0	0	0	1	1
	Injuries	0	0	0	0/0		0
2005	Crashes	0	0	0	0	3	4
	Injuries	0	0	0	0/0		1
2006	Crashes	0	0	0	0	4	4
	Injuries	0	0	0	0/0		0
2007	Crashes	0	0	2	2	0	4
	Injuries	0	0	4	3/0		5
Seven-year summary, 2001 through 2007							
	Crashes	0	0	2	2	16	21
	Injuries	0	0	4	3		6

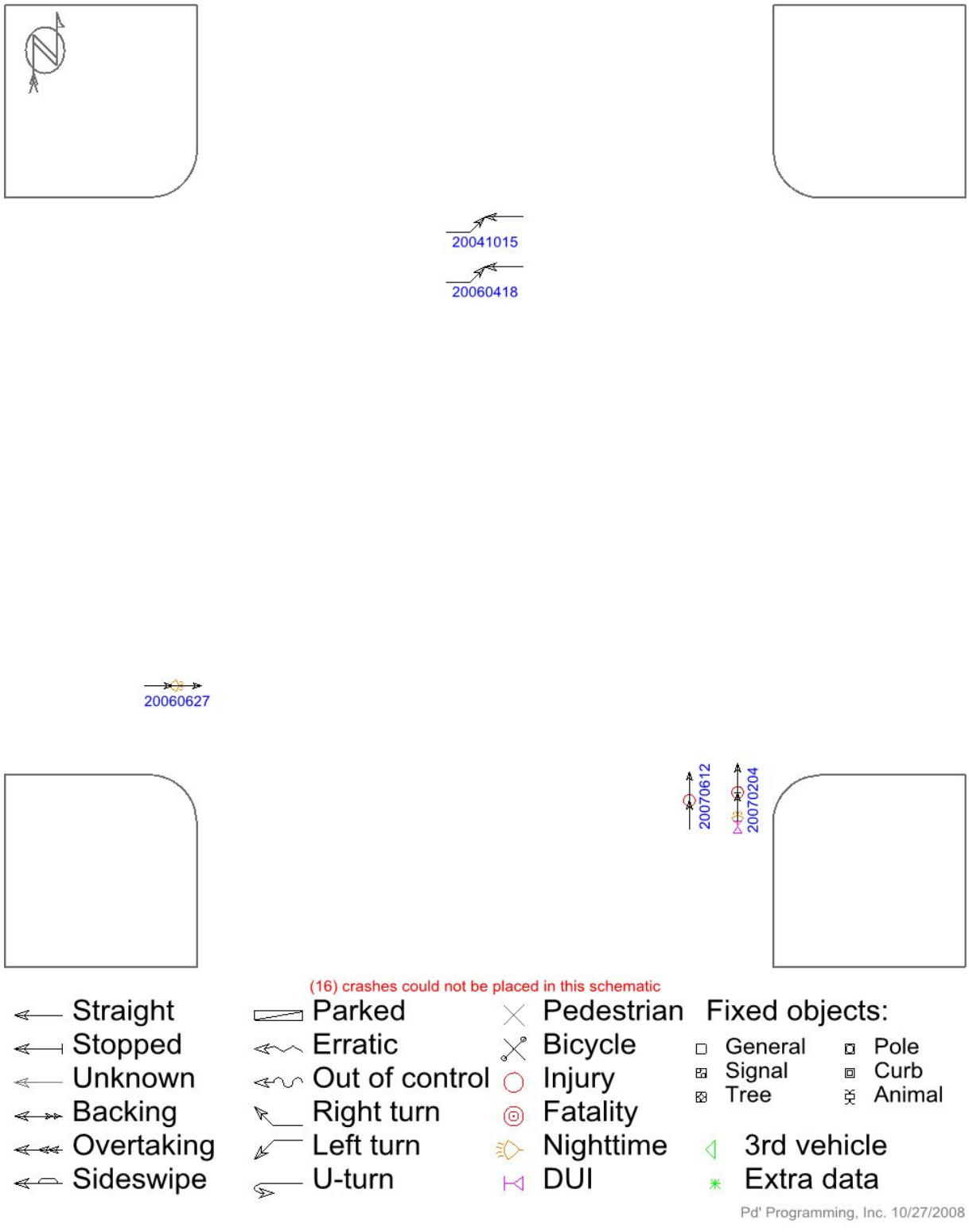

Figure C.2. Crash diagram for east terminal I-380 and Wright Brothers Blvd., 2001–2007

Table C.20. Crashes at interchange of I-380 and Wilson Ave., west terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	0	1	1	2
	Injuries	0	0	0	2/0		2
2002	Crashes	0	0	0	0	1	1
	Injuries	0	0	0	0/0		0
2003	Crashes	0	0	0	1	6	7
	Injuries	0	0	0	3/0		3
2004	Crashes	0	0	0	0	4	4
	Injuries	0	0	0	0/0		0
2005	Crashes	0	0	2	0	4	6
	Injuries	0	0	4	0/0		4
2006	Crashes	0	0	0	2	2	4
	Injuries	0	0	0	1/2		3
2007	Crashes	0	0	1	0	3	4
	Injuries	0	0	1	0/0		1
Seven-year summary, 2001 through 2007							
	Crashes	0	0	3	4	21	28
	Injuries	0	0	5	8		13

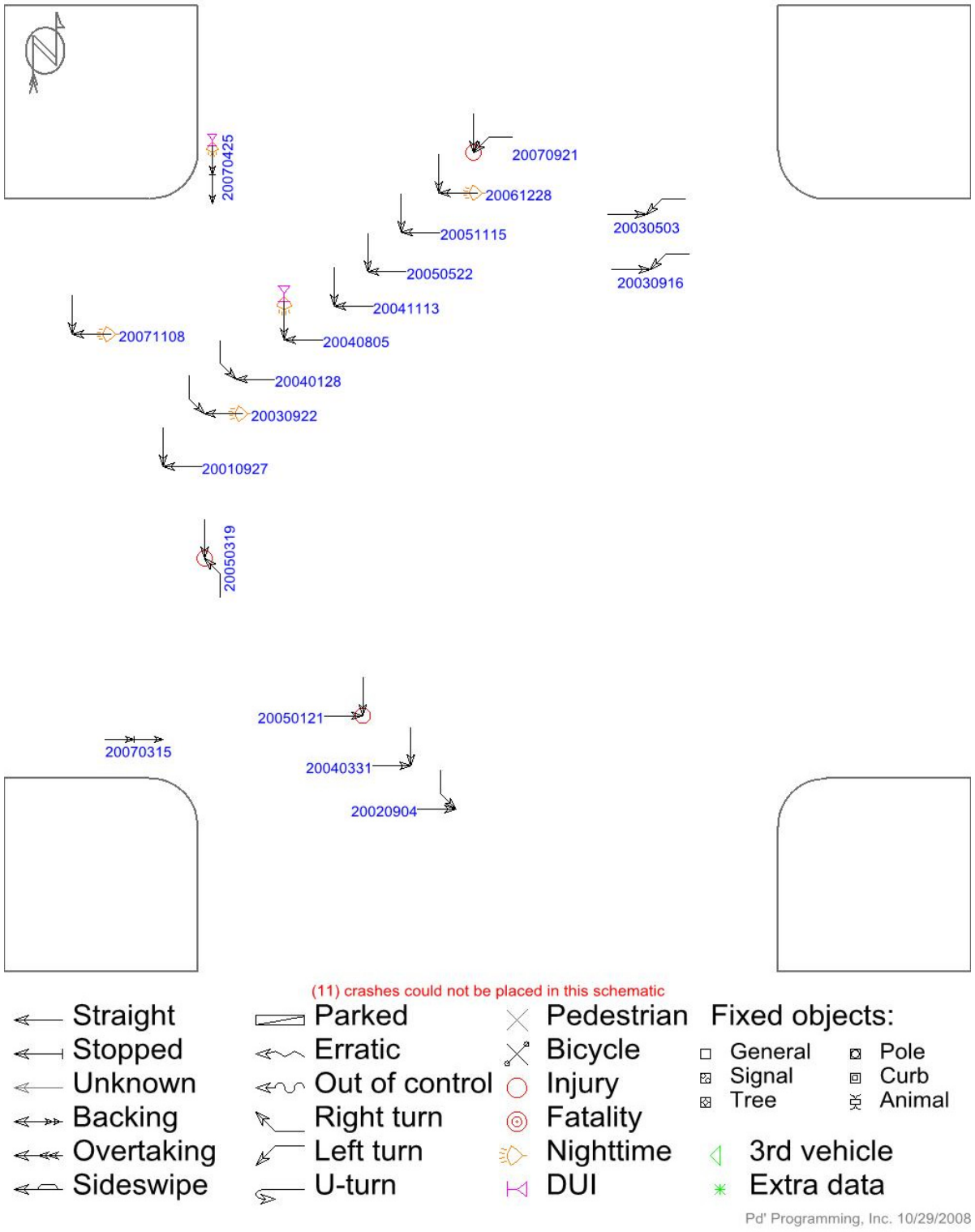

Figure C.3. Crash diagram for west terminal I-380 and Wilson Ave., 2001–2007

Table C.21. Crashes at interchange of I-380 and Wilson Ave., east terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	0	1	2	3
	Injuries	0	0	0	1/0		1
2002	Crashes	1	0	0	3	2	6
	Injuries	1	0	1	3/0		5
2003	Crashes	0	0	0	2	0	2
	Injuries	0	0	0	2/0		2
2004	Crashes	0	0	0	2	3	5
	Injuries	0	0	0	2/0		2
2005	Crashes	0	0	0	0	4	4
	Injuries	0	0	0	0/0		0
2006	Crashes	0	0	0	1	0	1
	Injuries	0	0	0	1/0		1
2007	Crashes	0	0	3	0	1	4
	Injuries	0	0	3	0/0		3
Seven-year summary, 2001 through 2007							
	Crashes	1	0	3	9	12	25
	Injuries	1	0	4	9		14

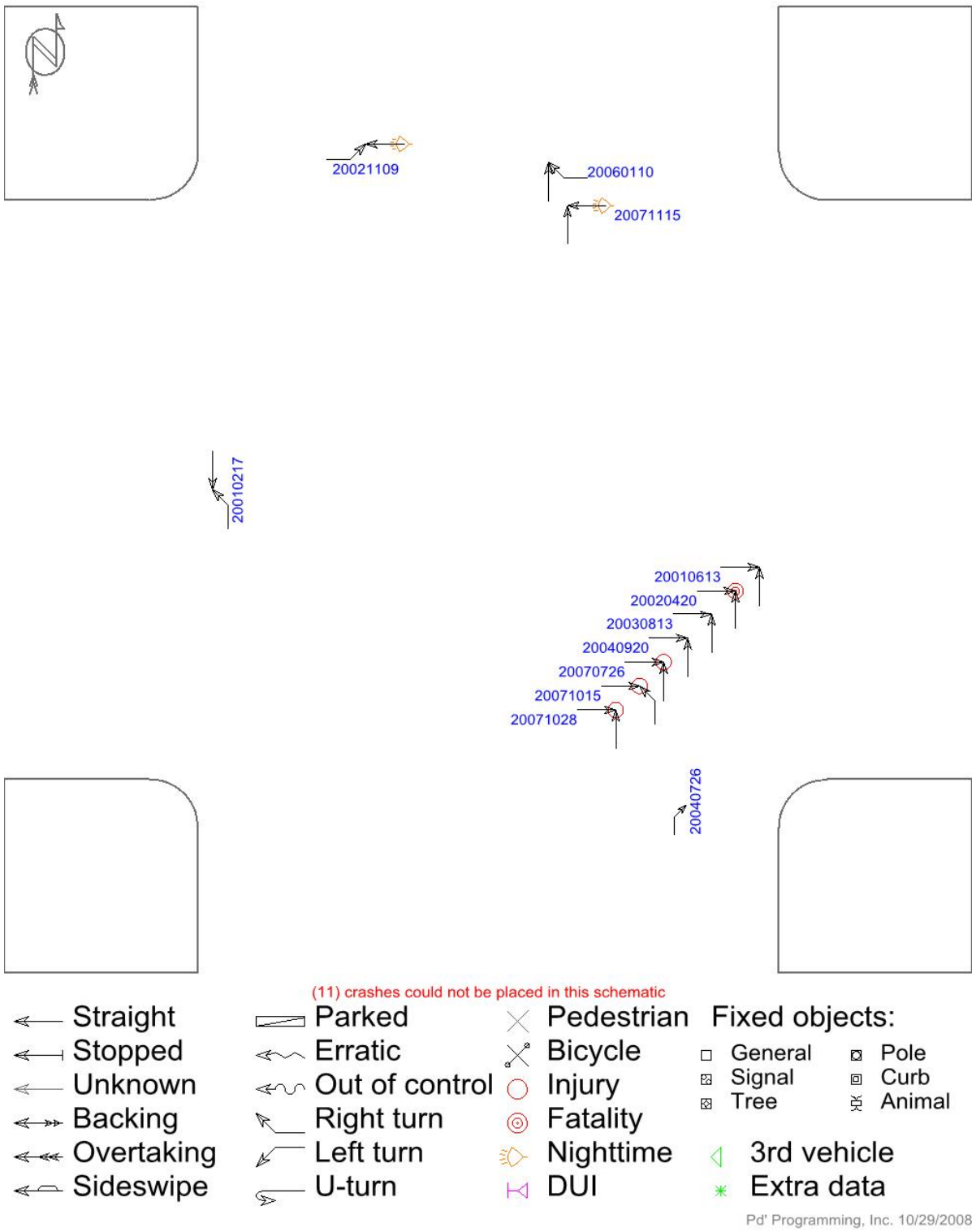

Figure C.4. Crash diagram for east terminal I-380 and Wilson Ave., 2001–2007

Table C.22. Crashes at interchange of I-380 and 1st Ave., west terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	1	2	4	7
	Injuries	0	0	1	2/0		3
2002	Crashes	0	0	1	4	8	13
	Injuries	0	0	2	5/0		7
2003	Crashes	0	0	1	2	8	11
	Injuries	0	0	2	5/0		7
2004	Crashes	0	0	2	0	8	10
	Injuries	0	0	3	0/0		3
2005	Crashes	0	0	1	1	7	9
	Injuries	0	0	1	1/0		2
2006	Crashes	0	0	2	2	6	10
	Injuries	0	0	3	2/1		6
2007	Crashes	0	0	1	1	11	13
	Injuries	0	0	2	1/0		3
Seven-year summary, 2001 through 2007							
	Crashes	0	0	9	12	52	73
	Injuries	0	0	14	17		31

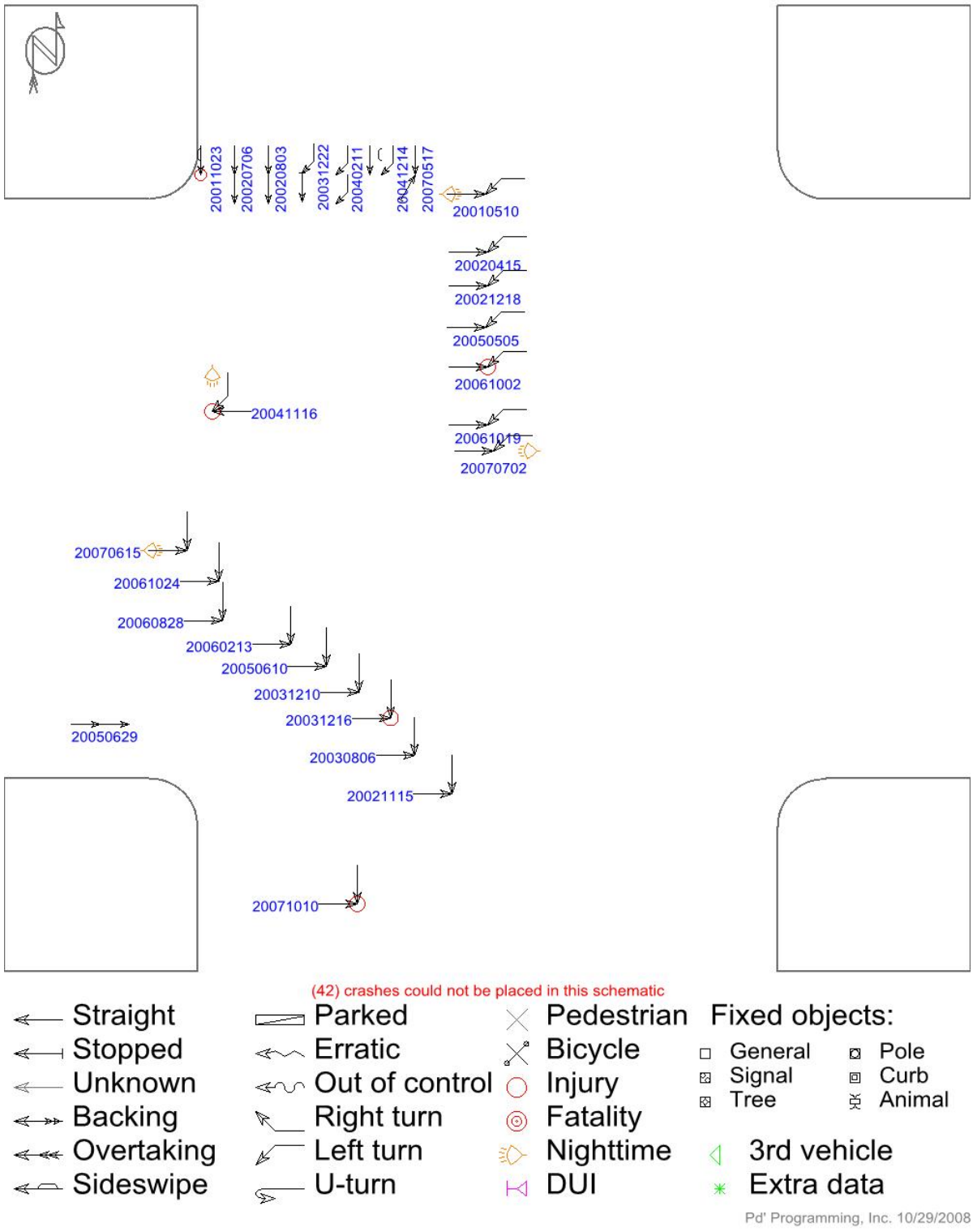

Figure C.5. Crash diagram for west terminal I-380 and 1st Ave., 2001–2007

Table C.23. Crashes at interchange of I-380 and 1st Ave., east terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	0	0	8	8
	Injuries	0	0	0	0/0		0
2002	Crashes	0	0	0	2	7	9
	Injuries	0	0	0	1/0		1
2003	Crashes	0	0	0	1	2	3
	Injuries	0	0	0	2/0		2
2004	Crashes	0	0	1	1	2	4
	Injuries	0	0	1	1/0		2
2005	Crashes	0	0	0	0	6	6
	Injuries	0	0	0	0/0		0
2006	Crashes	0	0	0	1	6	7
	Injuries	0	0	0	1/0		1
2007	Crashes	0	0	3	1	2	6
	Injuries	0	0	5	1/0		6
Seven-year summary, 2001 through 2007							
	Crashes	0	0	4	6	33	43
	Injuries	0	0	6	6		12

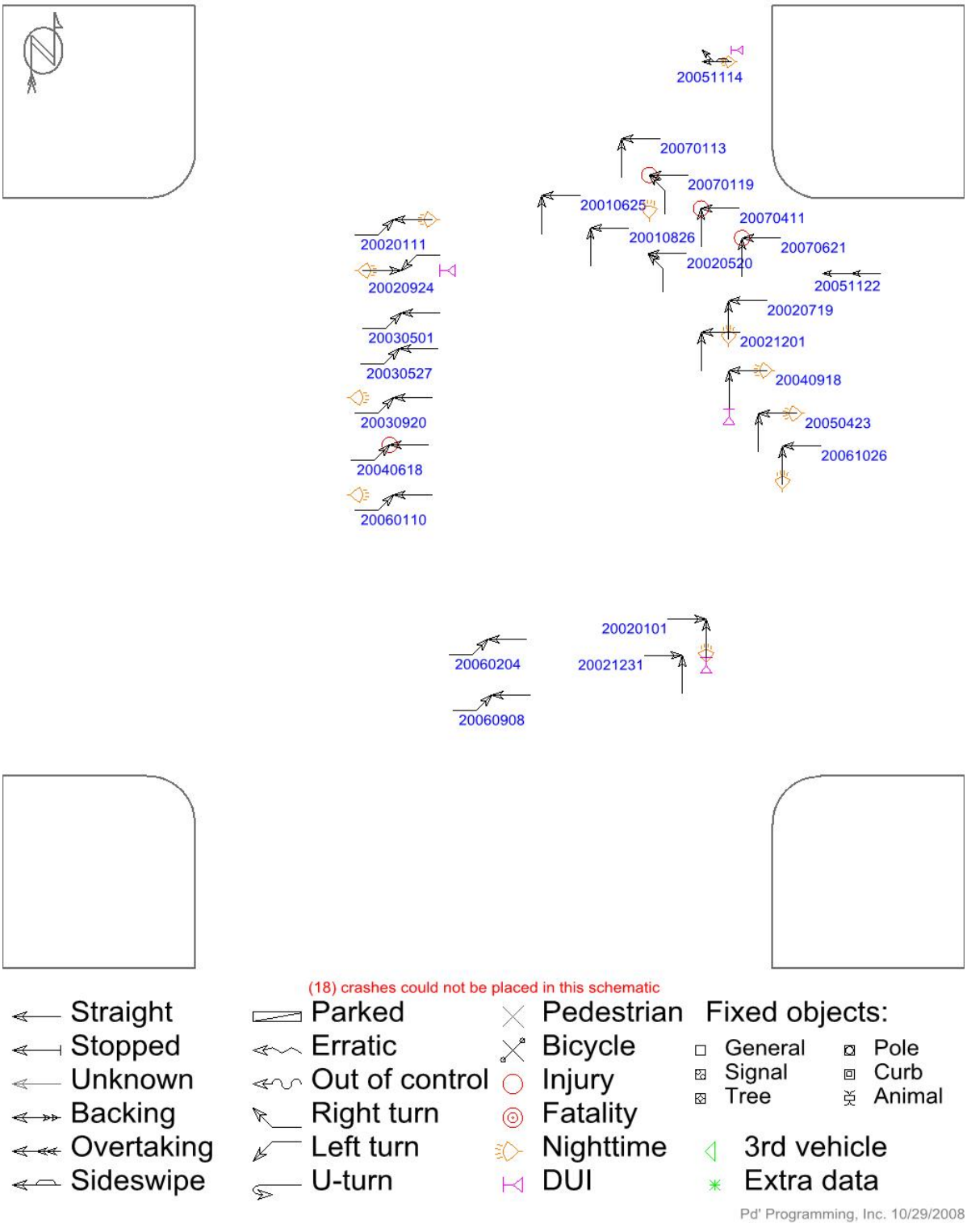

Figure C.6. Crash diagram for east terminal I-380 and 1st Ave., 2001–2007

Table C.24. Crashes at interchange of I-380 and J Ave., west terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	0	0	0	0
	Injuries	0	0	0	0/0		0
2002	Crashes	0	0	0	0	1	1
	Injuries	0	0	0	0/0		0
2003	Crashes	0	0	0	0	0	0
	Injuries	0	0	0	0/0		0
2004	Crashes	0	0	0	1	5	6
	Injuries	0	0	0	2/0		2
2005	Crashes	0	0	0	1	1	2
	Injuries	0	0	0	1/0		1
2006	Crashes	0	0	0	0	1	1
	Injuries	0	0	0	0/0		0
2007	Crashes	0	0	0	1	5	6
	Injuries	0	0	0	1/0		1
Seven-year summary, 2001 through 2007							
	Crashes	0	0	0	3	13	16
	Injuries	0	0	0	4		4

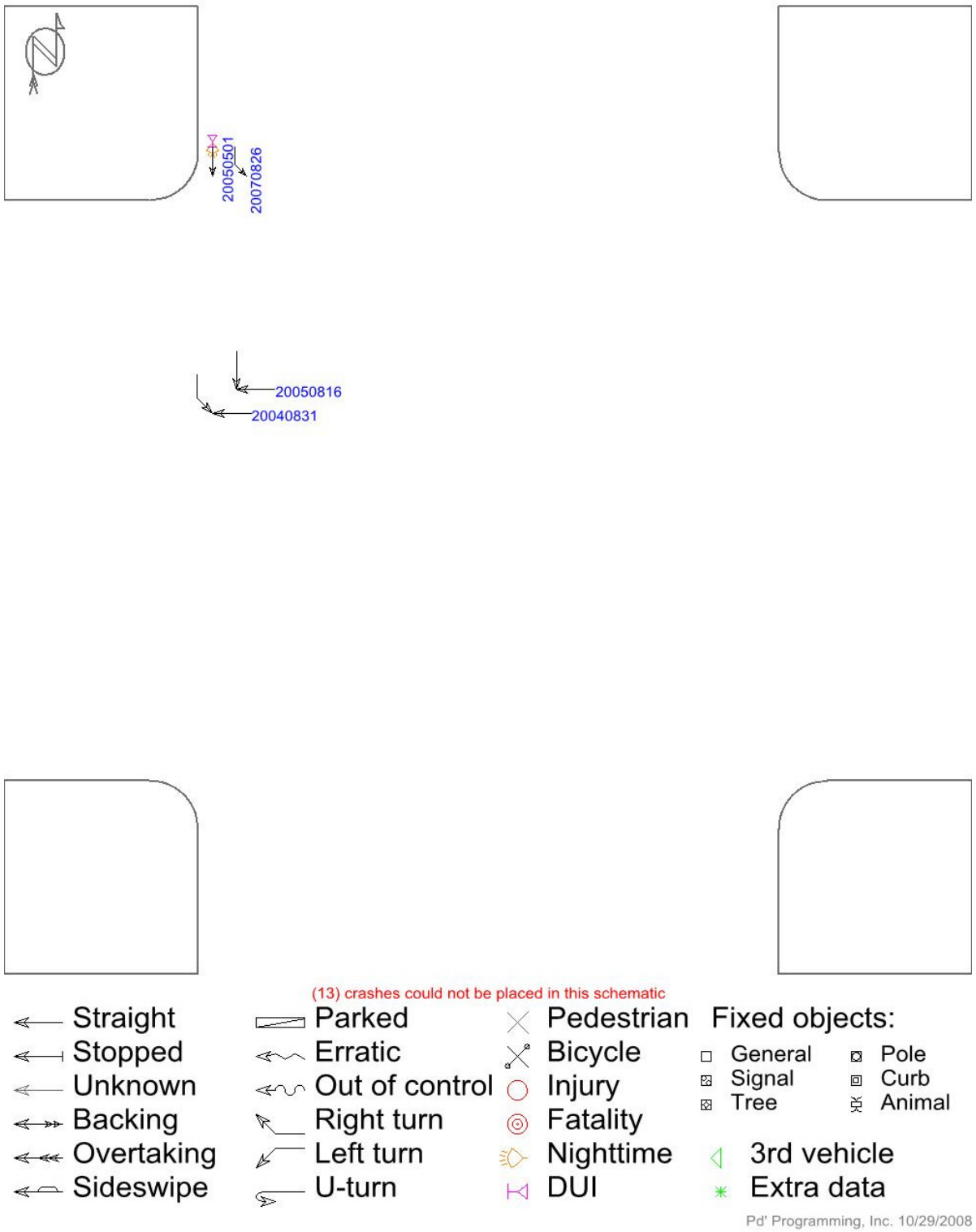

Figure C.7. Crash diagram for west terminal I-380 and J Ave., 2001–2007

Table C.25. Crashes at interchange of I-380 and J Ave., east terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	2	0	0	2
	Injuries	0	0	2	0/0		2
2002	Crashes	0	0	1	2	5	8
	Injuries	0	0	1	2/0		3
2003	Crashes	0	0	0	0	4	4
	Injuries	0	0	0	0/0		0
2004	Crashes	0	0	1	1	1	3
	Injuries	0	0	1	1/0		2
2005	Crashes	0	0	0	1	2	3
	Injuries	0	0	0	1/0		1
2006	Crashes	0	0	0	2	1	3
	Injuries	0	0	0	2/0		2
2007	Crashes	0	0	0	0	4	4
	Injuries	0	0	0	0/0		0
Seven-year summary, 2001 through 2007							
	Crashes	0	0	4	6	17	27
	Injuries	0	0	4	6		10

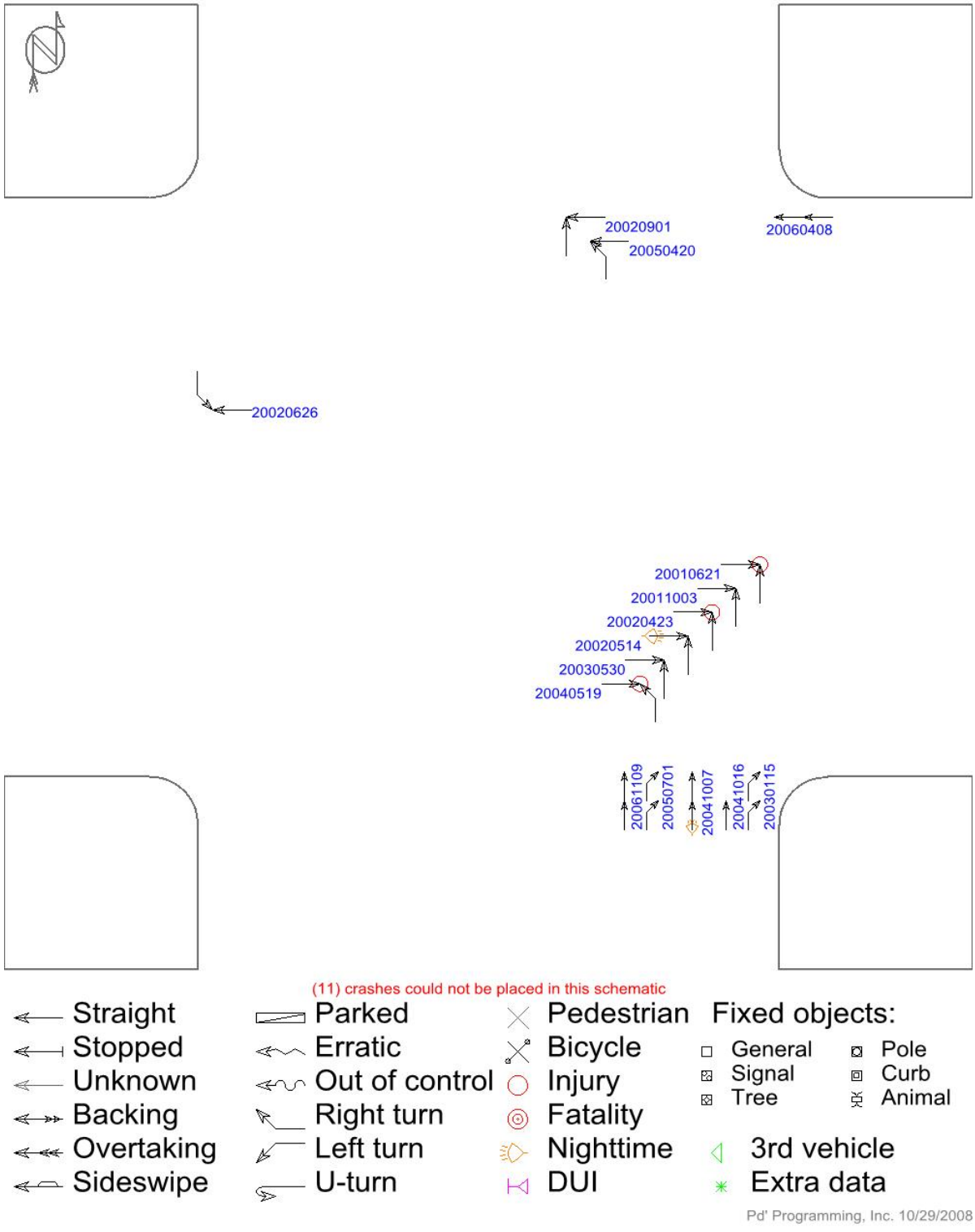

Figure C.8. Crash diagram for east terminal I-380 and J Ave., 2001–2007

Table C.26. Crashes at interchange of I-380 and Coldstream Ave., west terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	2	0	0	2
	Injuries	0	0	2	0/0		2
2002	Crashes	0	0	0	0	0	0
	Injuries	0	0	0	0/0		0
2003	Crashes	0	0	0	1	0	1
	Injuries	0	0	0	2/0		2
2004	Crashes	0	0	0	0	0	0
	Injuries	0	0	0	0/0		0
2005	Crashes	0	0	0	0	1	1
	Injuries	0	0	0	0/0		0
2006	Crashes	0	0	0	0	0	0
	Injuries	0	0	0	0/0		0
2007	Crashes	0	0	0	0	1	1
	Injuries	0	0	0	0/0		0
Seven-year summary, 2001 through 2007							
	Crashes	0	0	2	1	2	5
	Injuries	0	0	2	2		4

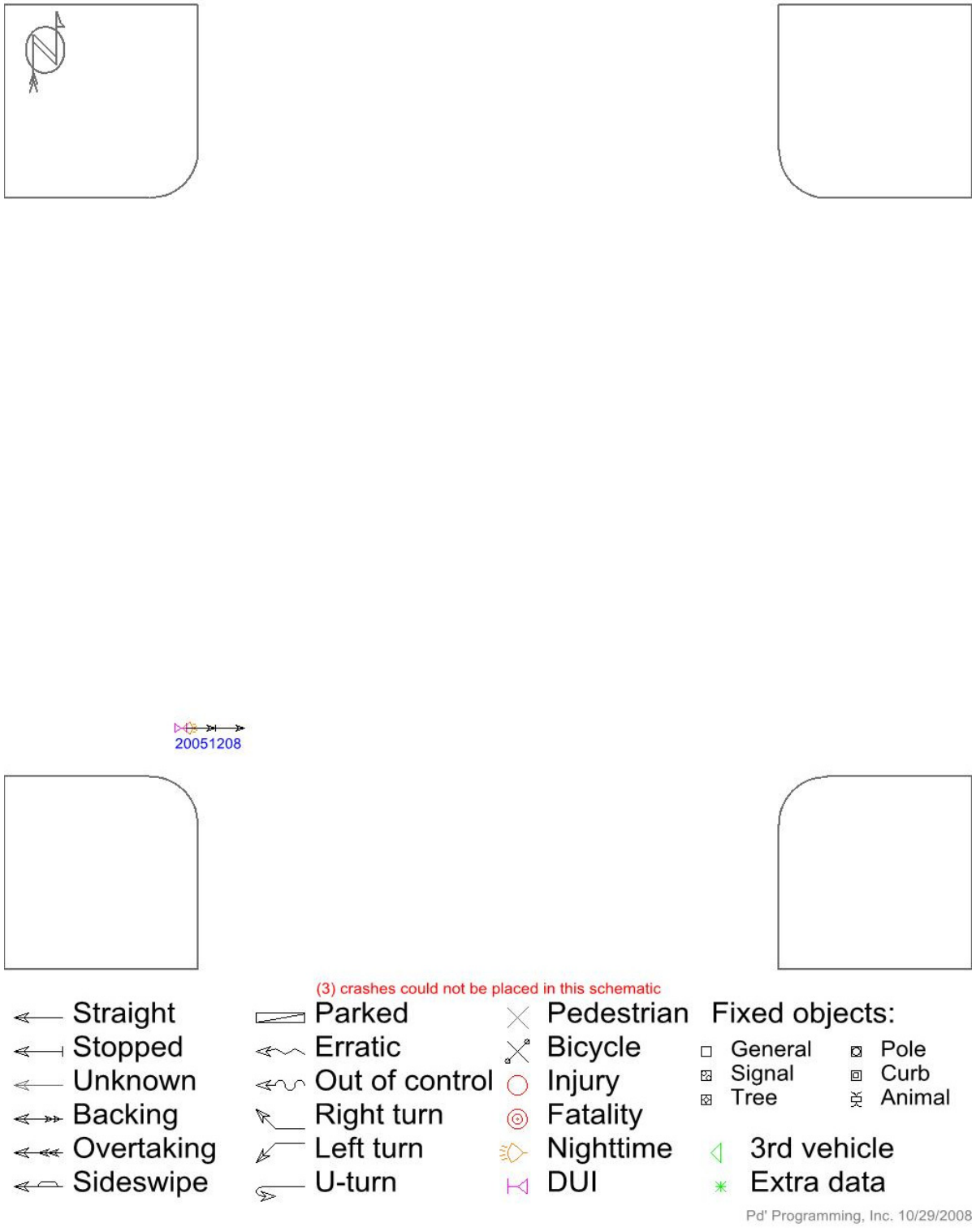

Figure C.9. Crash diagram for west terminal I-380 and Coldstream Ave., 2001–2007

Table C.27. Crashes at interchange of I-380 and Coldstream Ave., east terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	2	0	0	2
	Injuries	0	0	2	1/0		3
2002	Crashes	0	0	1	0	5	6
	Injuries	0	0	2	0/0		2
2003	Crashes	0	0	0	1	5	6
	Injuries	0	0	0	1/0		1
2004	Crashes	0	0	0	0	3	3
	Injuries	0	0	0	0/0		0
2005	Crashes	0	0	0	1	4	5
	Injuries	0	0	0	1/0		1
2006	Crashes	0	0	0	0	5	5
	Injuries	0	0	0	0/0		0
2007	Crashes	0	0	0	0	3	3
	Injuries	0	0	0	0/0		0
Seven-year summary, 2001 through 2007							
	Crashes	0	0	3	2	25	30
	Injuries	0	0	4	3		7

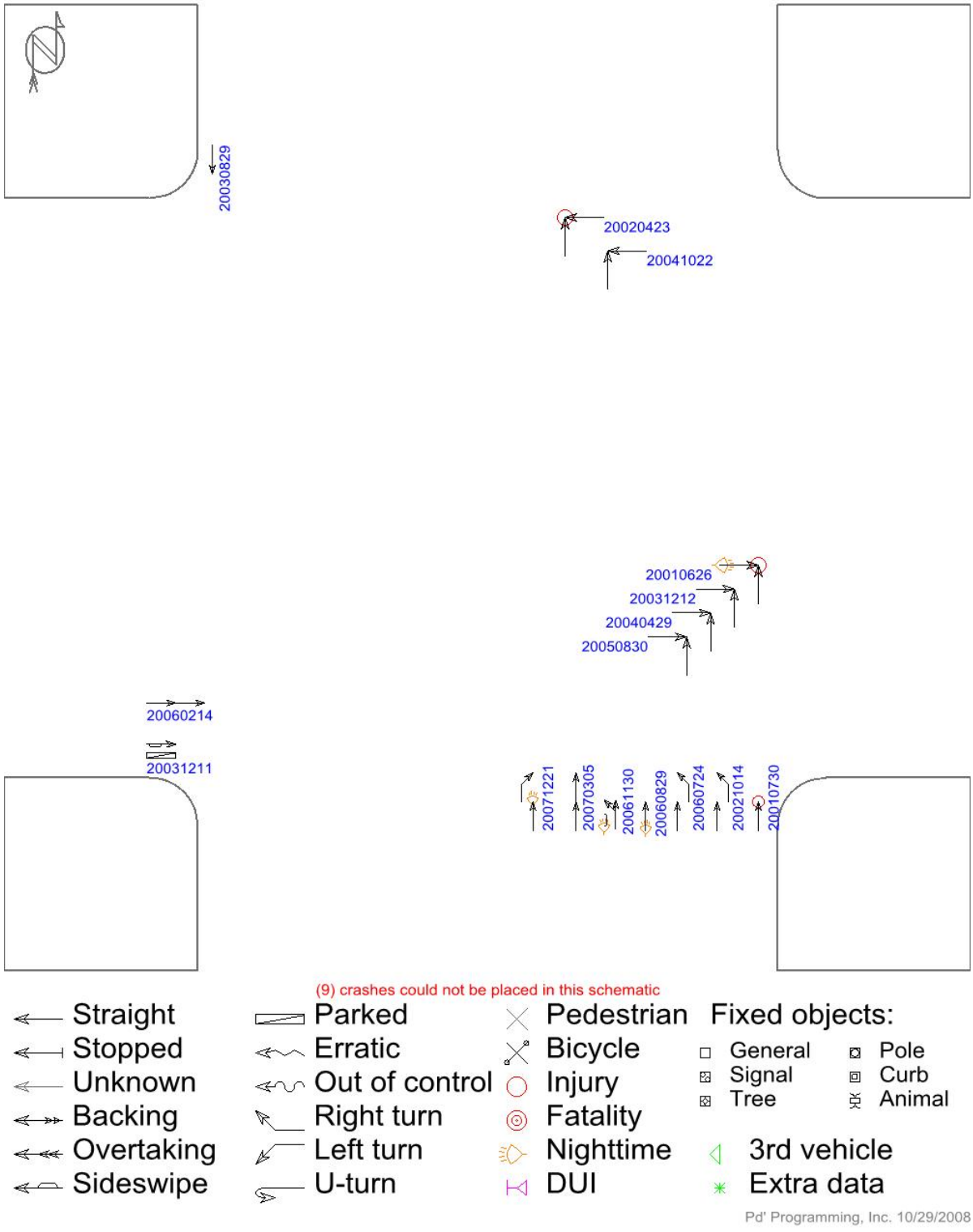

Figure C.10. Crash diagram for east terminal I-380 and Coldstream Ave., 2001–2007

Table C.28. Crashes at interchange of I-380 and Glass Road, west terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	0	0	2	2
	Injuries	0	0	0	0/0		0
2002	Crashes	0	0	0	0	1	1
	Injuries	0	0	0	0/0		0
2003	Crashes	0	0	1	2	2	5
	Injuries	0	0	1	6/0		7
2004	Crashes	0	0	0	0	3	3
	Injuries	0	0	0	0/0		0
2005	Crashes	0	0	0	0	2	2
	Injuries	0	0	0	0/0		0
2006	Crashes	0	0	0	0	1	1
	Injuries	0	0	0	0/0		0
2007	Crashes	0	0	0	1	0	1
	Injuries	0	0	0	1/0		1
Seven-year summary, 2001 through 2007							
	Crashes	0	0	1	3	11	15
	Injuries	0	0	1	7		8

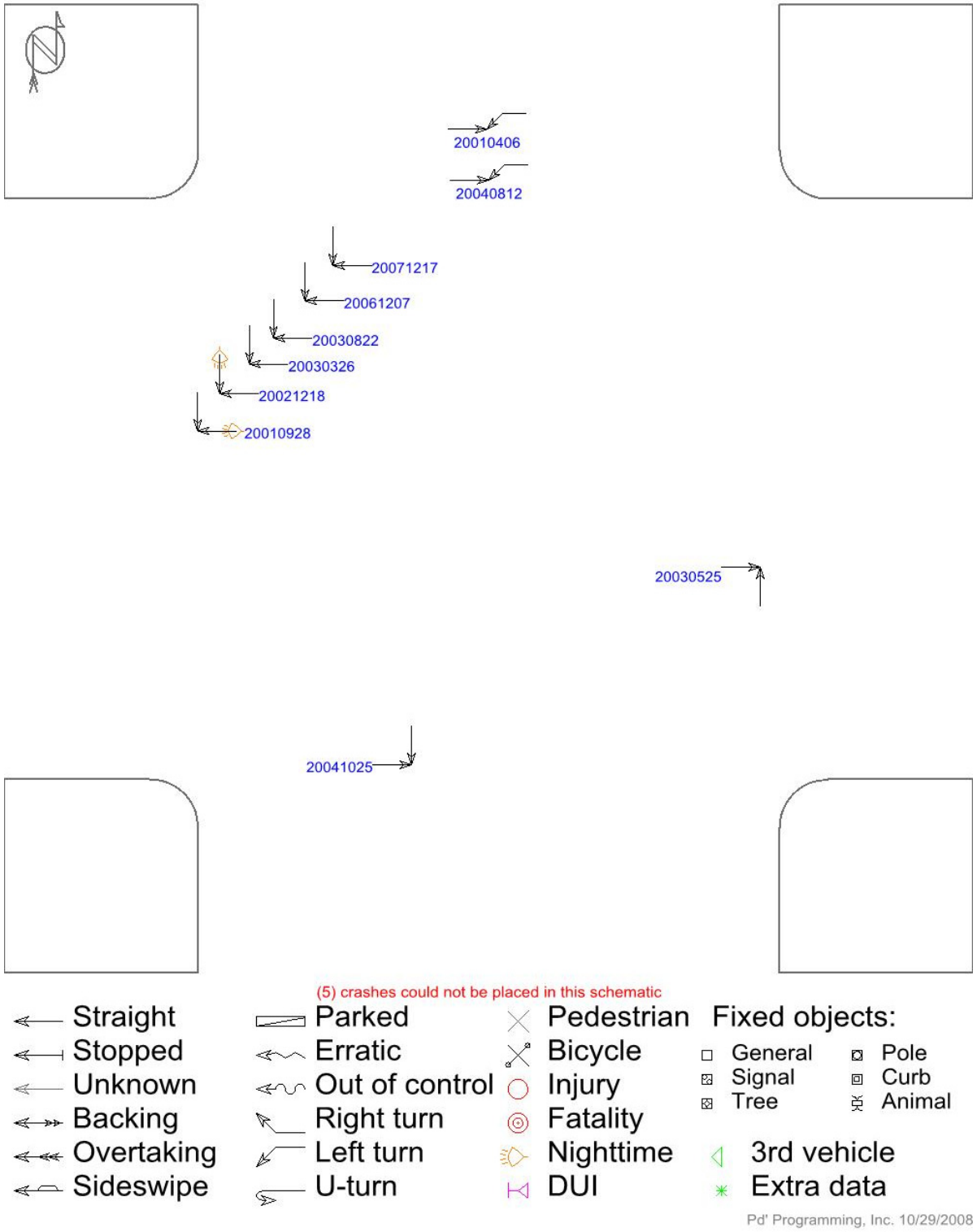

Figure C.11. Crash diagram for west terminal I-380 and Glass Road, 2001–2007

Table C.29. Crashes at interchange of I-380 and Glass Road, east terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	0	1	6	7
	Injuries	0	0	0	1/0		1
2002	Crashes	0	0	0	1	3	4
	Injuries	0	0	0	2/0		2
2003	Crashes	0	0	1	1	2	4
	Injuries	0	0	1	1/0		2
2004	Crashes	0	1	0	0	0	1
	Injuries	0	1	0	2/0		3
2005	Crashes	0	0	0	1	1	2
	Injuries	0	0	0	2/0		2
2006	Crashes	0	1	0	1	4	6
	Injuries	0	1	0	2/0		3
2007	Crashes	0	0	2	0	0	2
	Injuries	0	0	2	0/0		2
Seven-year summary, 2001 through 2007							
	Crashes	0	2	3	5	16	26
	Injuries	0	2	3	10		15

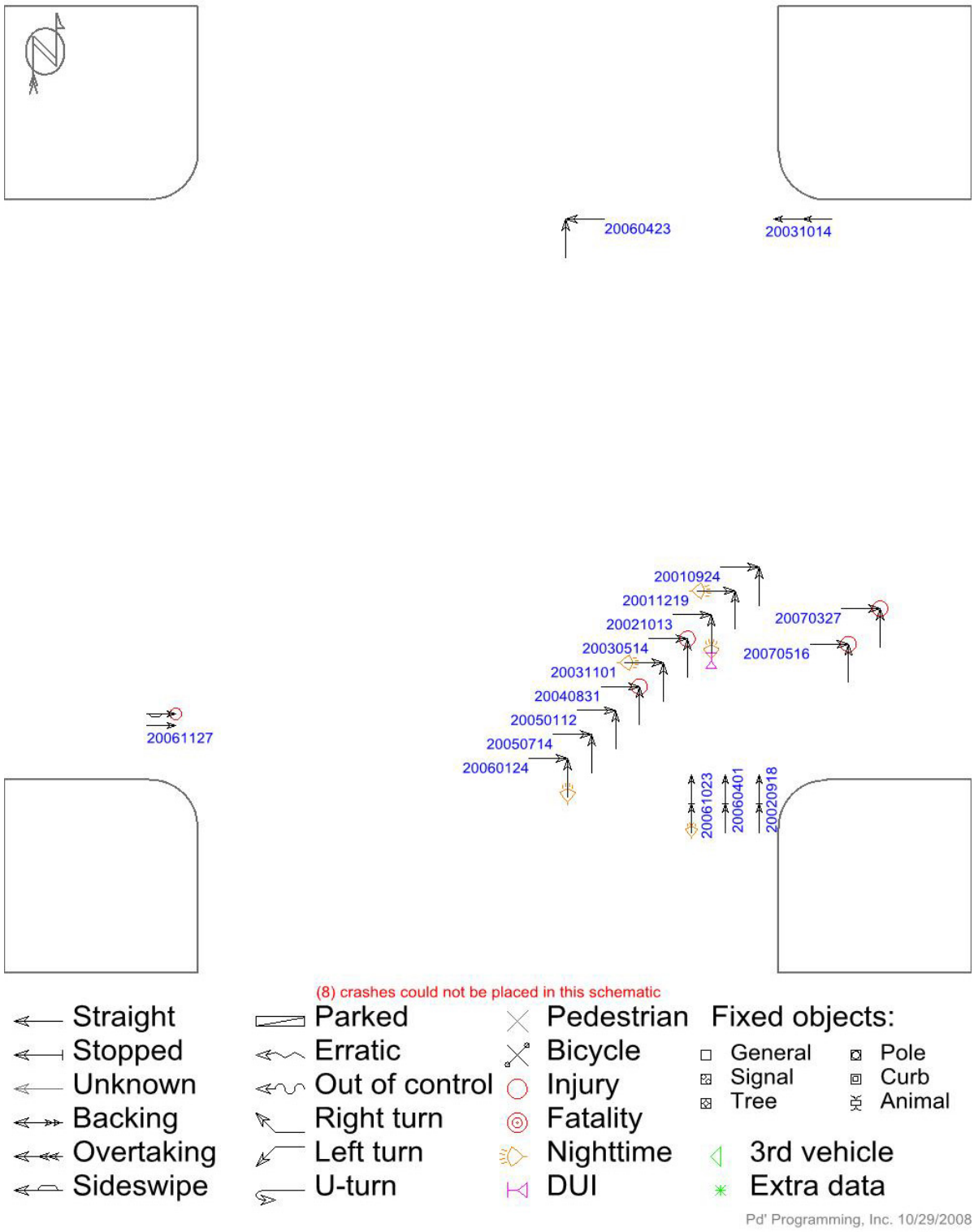

Figure C.12. Crash diagram for east terminal I-380 and Glass Road, 2001–2007

Table C.30. Crashes at interchange of I-380 and Blairs Ferry Road, west terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	0	1	3	4
	Injuries	0	0	0	1/0		1
2002	Crashes	0	0	3	1	4	8
	Injuries	0	0	3	3/0		6
2003	Crashes	0	0	0	1	3	4
	Injuries	0	0	0	1/1		2
2004	Crashes	0	0	1	1	3	5
	Injuries	0	0	2	1/0		3
2005	Crashes	0	0	2	2	3	7
	Injuries	0	0	2	2/0		4
2006	Crashes	0	0	0	0	2	2
	Injuries	0	0	0	0/0		0
2007	Crashes	0	0	1	1	2	4
	Injuries	0	0	1	1/0		2
Seven-year summary, 2001 through 2007							
	Crashes	0	0	7	7	20	34
	Injuries	0	0	8	10		8

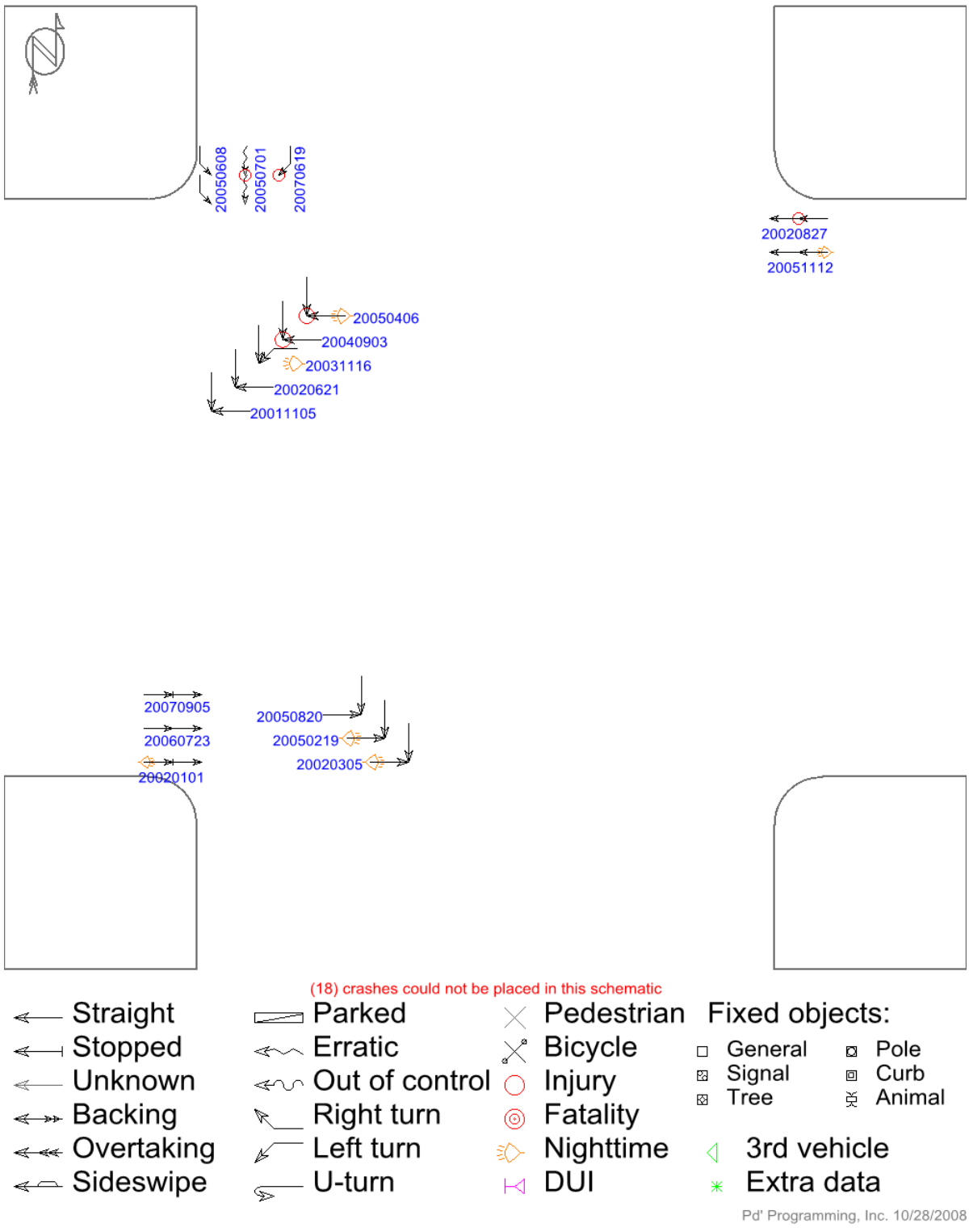

Figure C.13. Crash diagram for west terminal I-380 and Blairs Ferry Road, 2001–2007

Table C.31. Crashes at interchange of I-380 and Blairs Ferry Road, east terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	2	2	11	15
	Injuries	0	0	2	2/0		4
2002	Crashes	0	0	1	4	17	22
	Injuries	0	0	1	5/0		6
2003	Crashes	0	1	1	3	8	13
	Injuries	0	1	2	5/0		8
2004	Crashes	0	0	3	3	14	20
	Injuries	0	0	4	6/0		10
2005	Crashes	0	0	0	0	8	8
	Injuries	0	0	0	0/0		0
2006	Crashes	0	0	1	2	11	14
	Injuries	0	0	1	3/0		4
2007	Crashes	0	0	1	2	6	9
	Injuries	0	0	1	3/0		4
Seven-year summary, 2001 through 2007							
	Crashes	0	1	9	16	75	101
	Injuries	0	1	11	24		36

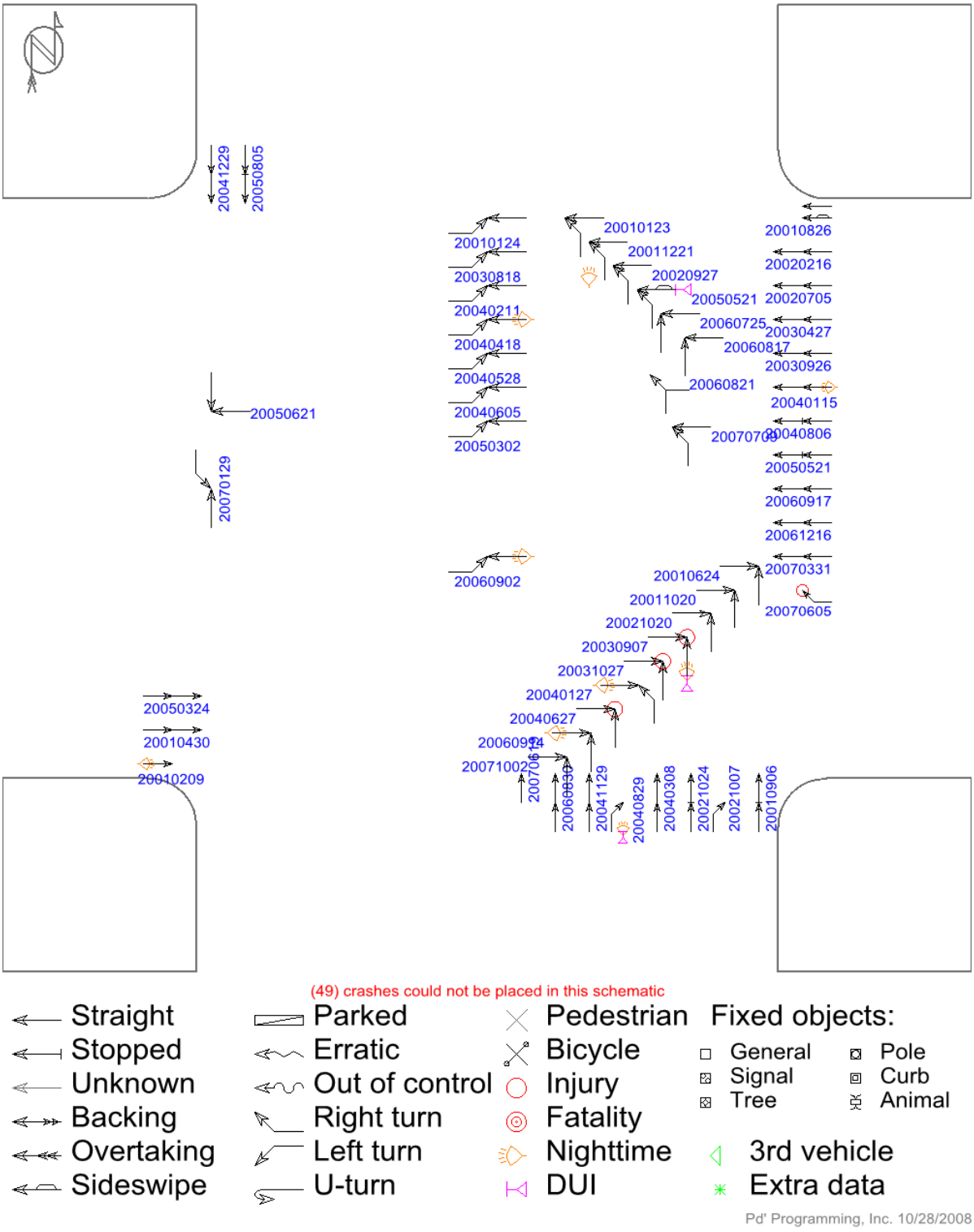

Figure C.14. Crash diagram for east terminal I-380 and Blairs Ferry Road, 2001–2007

Table C.32. Crashes at interchange of I-380 and Boyson Road, west terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	1	0	0	0	1	2
	Injuries	1	0	0	0/0		1
2002	Crashes	0	0	0	0	3	3
	Injuries	0	0	0	0/0		0
2003	Crashes	0	0	0	0	0	0
	Injuries	0	0	0	0/0		0
2004	Crashes	0	0	0	1	2	3
	Injuries	0	0	0	1/0		1
2005	Crashes	0	0	0	1	1	2
	Injuries	0	0	0	1/0		1
2006	Crashes	0	0	0	0	0	0
	Injuries	0	0	0	0/0		0
2007	Crashes	0	0	0	1	0	1
	Injuries	0	0	0	0/1		1
Seven-year summary, 2001 through 2007							
	Crashes	1	0	0	3	7	11
	Injuries	1	0	0	3		4

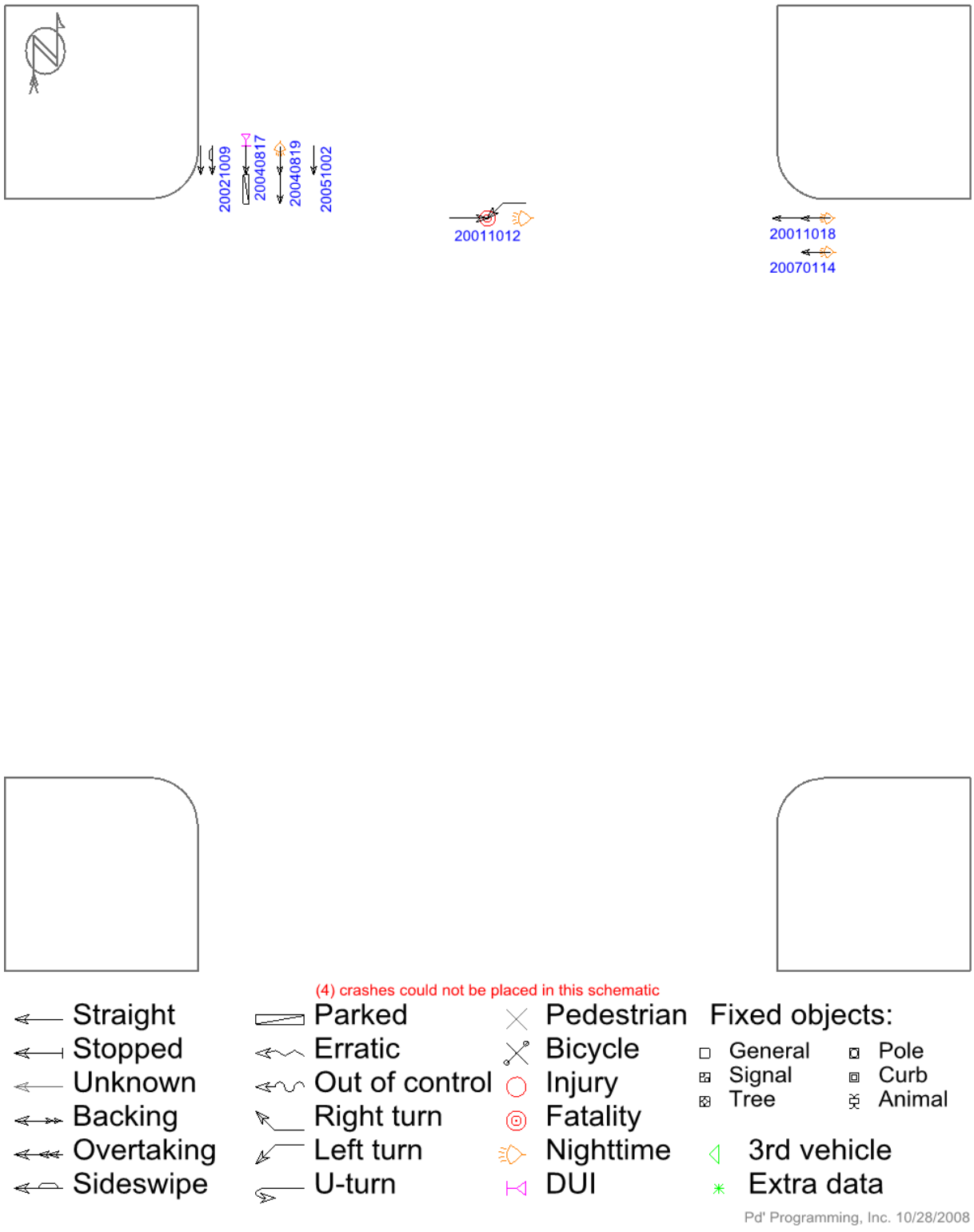

Figure C.15. Crash diagram for west terminal I-380 and Boyson Road, 2001–2007

Table C.33. Crashes at interchange of I-380 and Boyson Road, east terminal, 2001–2007

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	0	0	1	1
	Injuries	0	0	0	0/0		0
2002	Crashes	0	0	0	0	5	5
	Injuries	0	0	0	0/0		0
2003	Crashes	0	0	0	1	2	3
	Injuries	0	0	0	3/0		3
2004	Crashes	0	0	1	0	0	1
	Injuries	0	0	1	0/0		1
2005	Crashes	0	0	0	2	0	2
	Injuries	0	0	0	3/0		3
2006	Crashes	0	0	0	1	2	3
	Injuries	0	0	0	1/0		1
2007	Crashes	0	0	0	1	4	5
	Injuries	0	0	0	1/0		1
Seven-year summary, 2001 through 2007							
	Crashes	0	0	1	5	14	20
	Injuries	0	0	1	8		9

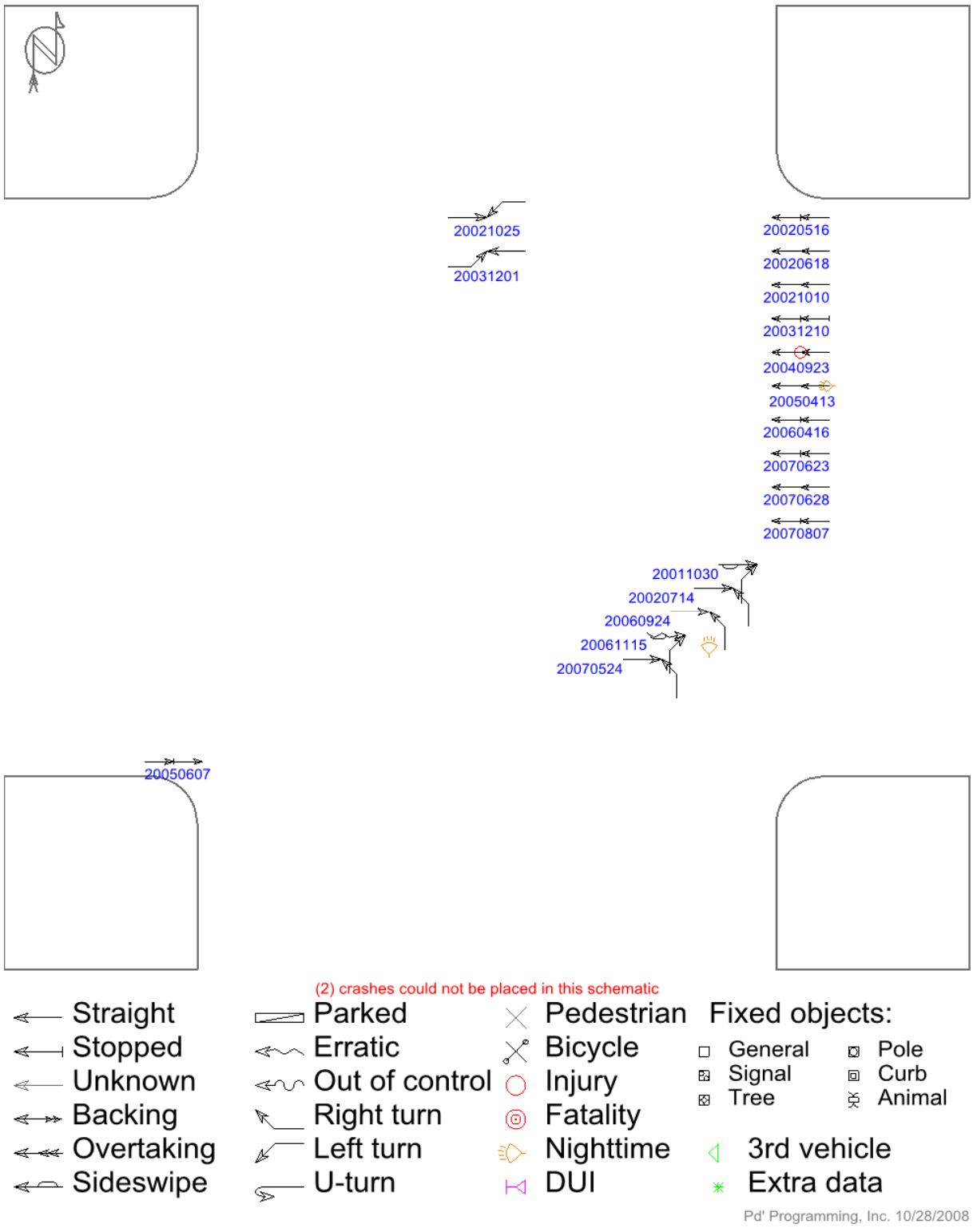

Figure C.16. Crash diagram for east terminal I-380 and Boyson Road, 2001–2007

Table C.34. All crashes near Cedar River Bridge (1st Ave. to 1st St.), 2001 through Nov. 2008

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	1	2	2	9	14
	Injuries	0	1	4	6/0		11
2002	Crashes	0	0	3	6	10	19
	Injuries	0	0	3	5/1		9
2003	Crashes	0	0	2	5	8	15
	Injuries	0	0	2	4/1		7
2004	Crashes	0	0	4	7	15	26
	Injuries	0	0	5	7/0		12
2005	Crashes	0	0	3	2	14	19
	Injuries	0	0	3	3/0		6
2006	Crashes	1	1	1	3	9	15
	Injuries	1	1	1	5/0		8
2007	Crashes	0	0	1	6	9	16
	Injuries	0	0	1	7/0		8
2008 (to Nov.)	Crashes	0	2	4	5	4	15
	Injuries	0	2	5	5/0		12
Eight-year summary, 2001 through Nov. 2008							
	Crashes	1	4	20	36	78	139
	Injuries	1	4	24	44		73

Table C.35. Large vehicle crashes on Cedar River Bridge, 2001 through Nov. 2008

		Fatal	Major injury	Minor injury	Possible/ unknown	PDO	Total
2001	Crashes	0	0	0	0	1	1
	Injuries	0	0	0	0/0		0
2002	Crashes	0	0	0	2	1	3
	Injuries	0	0	0	2/0		2
2003	Crashes	0	0	0	0	0	0
	Injuries	0	0	0	0/0		0
2004	Crashes	0	0	0	0	1	1
	Injuries	0	0	0	0/0		0
2005	Crashes	0	0	0	1	1	2
	Injuries	0	0	0	1/0		1
2006	Crashes	1	0	0	0	1	2
	Injuries	1	0	0	0/0		1
2007	Crashes	0	0	1	2	1	4
	Injuries	0	0	1	2/0		3
2008 (to Nov.)	Crashes	0	0	1	2	1	4
	Injuries	0	0	1	2/0		3
Eight-year summary, 2001 through Nov. 2008							
	Crashes	1	0	2	7	7	17
	Injuries	1	0	2	7		10

Table C.36. Detailed case-by-case listing for large vehicle crashes on the Cedar River Bridge, 2001 though Nov. 2008

First Harmful Event	CRCO Manner	C. Severity	Fatalities	Injuries	Prop. Dmg
Collision with: Vehicle in traffic	Sideswipe - same direction	Property Damage Only	0	0	1990
Collision with: Vehicle in traffic	Rear-end	Possible/ Unknown	0	1	17200
Non-collision events: Jackknife	Non-collision	Possible/ Unknown	0	1	16000
Collision with: Vehicle in traffic	Sideswipe - same direction	Property Damage Only	0	0	3000
Collision with fixed object: Impact attenuator	Non-collision	Property Damage Only	0	0	14506
Collision with fixed object: Bridge/bridge rail/overpass	Non-collision	Possible/ Unknown	0	1	131634
Collision with: Vehicle in traffic	Sideswipe - same direction	Property Damage Only	0	0	1000
Collision with: Vehicle in traffic	Rear-end	Property Damage Only	0	0	21000
Non-collision events: Jackknife	Non-collision	Fatal	1	0	183676
Collision with: Vehicle in traffic	Non-collision	Minor Injury	0	1	95000
Collision with: Vehicle in traffic	Non-collision	Possible/ Unknown	0	1	10000
Collision with fixed object: Guardrail	Sideswipe - same direction	Possible/ Unknown	0	1	85500
Collision with: Vehicle in/from other roadway	Angle - oncoming left turn	Property Damage Only	0	0	Number N
Collision with fixed object: Bridge/bridge rail/overpass	Non-collision	Possible/ Unknown	0	1	130000
Non-collision events: Jackknife	Unknown	Possible/ Unknown	0	1	85000
Collision with fixed object: Guardrail	Non-collision	Property Damage Only	0	0	12000
Non-collision events: Jackknife	Non-collision	Minor Injury	0	1	100000

Table C.36. Detailed case-by-case listing for large vehicle crashes on the Cedar River Bridge, 2001 though Nov. 2008 (continued)

First Harmful Event	Day	Date	Time	Light	Weather 1	Surf. Cond.	Major Cause
Collision with: Vehicle in traffic	Fri.	2001/ 02/09	1330	Daylight	Snow	Snow	Swerving/Evasive Action
Collision with: Vehicle in traffic	Wed.	2002/ 05/29	706	Daylight	Rain	Wet	Unknown
Non-collision events: Jackknife	Wed.	2002/ 07/10	2305	Dark - roadway lighted	Rain	Wet	Unknown
Collision with: Vehicle in traffic	Fri.	2002/ 10/11	1655	Daylight	Clear	Dry	Other (explain in narrative): Other improper action
Collision with fixed object: Impact attenuator	Thurs.	2004/ 08/26	2248	Dark - roadway lighted	Rain	Wet	Driving too fast for conditions
Collision with fixed object: Bridge/bridge rail/overpass	Sat.	2005/ 05/07	438	Dark - roadway lighted	Rain	Wet	Ran off road - left
Collision with: Vehicle in traffic	Fri.	2005/ 12/02	1745	Dark - roadway lighted	Snow	Wet	Unknown
Collision with: Vehicle in traffic	Sat.	2006/ 09/09	2230	Dark - roadway lighted	Rain	Wet	None indicated
Non-collision events: Jackknife	Sun.	2006/ 09/10	1201	Daylight	Rain	Wet	Lost Control
Collision with: Vehicle in traffic	Thurs.	2007/ 05/24	1209	Daylight	Rain	Wet	Driving too fast for conditions
Collision with: Vehicle in traffic	Sun.	2007/ 06/03	1228	Daylight	Rain	Wet	Lost Control
Collision with fixed object: Guardrail	Fri.	2007/ 09/07	233	Dark - roadway lighted	Rain	Wet	Swerving/Evasive Action
Collision with: Vehicle in/from other roadway	Wed.	2007/ 11/21	1020	Daylight	Partly cloudy	Dry	FTYROW: From yield sign
Collision with fixed object: Bridge/bridge rail/overpass	Mon.	2008/ 03/17	1455	Daylight	Rain	Wet	Swerving/Evasive Action
Non-collision events: Jackknife	Tues.	2008/ 06/03	941	Daylight	Rain	Wet	Lost Control
Collision with fixed object: Guardrail	Thurs.	2008/ 08/21	1000	Daylight	Rain	Wet	Over correcting/over steering
Non-collision events: Jackknife	Mon.	2008/ 09/08	947	Daylight	Rain	Wet	Lost Control

Table C.36. Detailed case-by-case listing for large vehicle crashes on the Cedar River Bridge, 2001 though Nov. 2008 (continued)

First Harmful Event	Init. Dir.	V. Config.	Repair Cost	Seq. Events 1
Collision with: Vehicle in traffic	Not Reported	Sport utility vehicle	990	Not Reported
	Not Reported	Tractor/semi-trailer	1000	Not Reported
Collision with: Vehicle in traffic	South	Passenger car	6000	Collision with: Vehicle in traffic
	South	Four-tire light truck (pick-up/panel)	1000	Collision with: Vehicle in traffic
	South	Not Reported	10000	Not Reported
	South	Truck/trailer	100	Collision with: Vehicle in traffic
	South	Truck/trailer	100	Collision with: Vehicle in traffic
Non-collision events: Jackknife	North	Tractor/semi-trailer	15000	Non-collision events: Jackknife
Collision with: Vehicle in traffic	West	Passenger car	2000	Collision with: Vehicle in traffic
	West	Tractor/semi-trailer	1000	Collision with: Vehicle in traffic
Collision with fixed object: Impact attenuator	North	Tractor/semi-trailer	6000	Collision with fixed object: Impact attenuator
Collision with fixed object: Bridge/bridge rail/overpass	North	Tractor/semi-trailer	125000	Non-collision events: Jackknife
Collision with: Vehicle in traffic	Not Reported	Passenger car	1000	Not Reported
	Not Reported	Tractor/semi-trailer	0	Not Reported
Collision with: Vehicle in traffic	Not Reported	Tractor/semi-trailer	19000	Not Reported
	Not Reported	Tractor/semi-trailer	1000	Not Reported
	Not Reported	Not Reported	1000	Not Reported
Non-collision events: Jackknife	North	Tractor/semi-trailer	175000	Non-collision events: Jackknife
Collision with: Vehicle in traffic	East	Tractor/semi-trailer	95000	Collision with: Vehicle in traffic
Collision with: Vehicle in traffic	South	Tractor/semi-trailer	10000	Collision with: Vehicle in traffic
Collision with fixed object: Guardrail	South	Tractor/semi-trailer	75000	Collision with fixed object: Guardrail
	South	Tractor/semi-trailer	3500	Collision with: Vehicle in traffic
	South	Tractor/semi-trailer	7000	Collision with: Vehicle in traffic
Collision with: Vehicle in/from other roadway	Not Reported	Tractor/triples	1000	Not Reported
	Not Reported	Passenger car	Number N	Not Reported
Collision with fixed object: Bridge/bridge rail/overpass	North	Tractor/semi-trailer	130000	Pre-crash events: Evasive action (swerve/panic braking/etc.)
Non-collision events: Jackknife	South	Tractor/semi-trailer	85000	Non-collision events: Jackknife
Collision with fixed object: Guardrail	North	Tractor/semi-trailer	12000	Pre-crash events: Ran off road - left
Non-collision events: Jackknife	North	Tractor/semi-trailer	100000	Non-collision events: Jackknife

Table C.36. Detailed case-by-case listing for large vehicle crashes on the Cedar River Bridge, 2001 though Nov. 2008 (continued)

First Harmful Event	Seq. Events 2	Seq. Events 3	Seq. Events 4
Collision with: Vehicle in traffic	Not Reported	Not Reported	Not Reported
	Not Reported	Not Reported	Not Reported
Collision with: Vehicle in traffic	Collision with: Vehicle in traffic	Collision with: Vehicle in traffic	Not Reported
	Collision with: Vehicle in traffic	Not Reported	Not Reported
	Not Reported	Not Reported	Not Reported
	Misc. events: Hit and run	Not Reported	Not Reported
	Misc. events: Hit and run	Not Reported	Not Reported
Non-collision events: Jackknife	Collision with fixed object: Guardrail	Not Reported	Not Reported
Collision with: Vehicle in traffic	Collision with fixed object: Bridge/bridge rail/overpass	Not Reported	Not Reported
	Not Reported	Not Reported	Not Reported
Collision with fixed object: Impact attenuator	Pre-crash events: Cargo/equipment loss or shift	Not Reported	Not Reported
Collision with fixed object: Bridge/bridge rail/overpass	Pre-crash events: Ran off road - left	Collision with fixed object: Bridge/bridge rail/overpass	Non-collision events: Other non-collision (explain in narrative)
Collision with: Vehicle in traffic	Not Reported	Not Reported	Not Reported
	Not Reported	Not Reported	Not Reported
Collision with: Vehicle in traffic	Not Reported	Not Reported	Not Reported
	Not Reported	Not Reported	Not Reported
	Not Reported	Not Reported	Not Reported
Non-collision events: Jackknife	Collision with fixed object: Bridge/bridge rail/overpass	Misc. events: Fire/explosion	Not Reported
Collision with: Vehicle in traffic	Collision with fixed object: Bridge/bridge rail/overpass	Collision with fixed object: Guardrail	Non-collision events: Jackknife
Collision with: Vehicle in traffic	Collision with fixed object: Guardrail	Not Reported	Not Reported
Collision with fixed object: Guardrail	Non-collision events: Jackknife	Not Reported	Not Reported
	Not Reported	Not Reported	Not Reported
	Collision with fixed object: Guardrail	Not Reported	Not Reported
Collision with: Vehicle in/from other roadway	Not Reported	Not Reported	Not Reported
	Not Reported	Not Reported	Not Reported
Collision with fixed object: Bridge/bridge rail/overpass	Collision with fixed object: Bridge/bridge rail/overpass	Pre-crash events: Ran off road - left	Non-collision events: Overturn/rollover
Non-collision events: Jackknife	Collision with fixed object: Guardrail	Not Reported	Not Reported
Collision with fixed object: Guardrail	Collision with fixed object: Impact attenuator	Non-collision events: Jackknife	Collision with fixed object: Guardrail
Non-collision events: Jackknife	Not Reported	Not Reported	Not Reported

Table C.36. Detailed case-by-case listing for large vehicle crashes on the Cedar River Bridge, 2001 though Nov. 2008 (continued)

First Harmful Event	R. Cont. Circ.	E. Cont. Circ.	Driver Age	Driver Gen.
Collision with: Vehicle in traffic	Not Reported	Not Reported	47	Male
			31	Male
Collision with: Vehicle in traffic	None apparent	Weather conditions	22	Female
			30	Male
			Unknown	Not Reported
			Unknown	Not Reported
			Unknown	Not Reported
Non-collision events: Jackknife	Road surface condition	Weather conditions	39	Male
Collision with: Vehicle in traffic	None apparent	None apparent	16	Male
			40	Male
Collision with fixed object: Impact attenuator	None apparent	Weather conditions	36	Male
Collision with fixed object: Bridge/bridge rail/overpass	Road surface condition	None apparent	31	Male
Collision with: Vehicle in traffic	Not Reported	Not Reported	39	Female
			62	Male
Collision with: Vehicle in traffic	Not Reported	Not Reported	43	Male
			51	Male
			Unknown	Not Reported
Non-collision events: Jackknife	Road surface condition	None apparent	47	Male
Collision with: Vehicle in traffic	None apparent	Weather conditions	63	Male
Collision with: Vehicle in traffic	None apparent	None apparent	45	Male
Collision with fixed object: Guardrail	None apparent	Weather conditions	41	Male
			45	Male
			35	Male
Collision with: Vehicle in/from other roadway	Not Reported	Not Reported	25	Male
			18	Male
Collision with fixed object: Bridge/bridge rail/overpass	Road surface condition	None apparent	41	Male
Non-collision events: Jackknife	None apparent	None apparent	35	Male
Collision with fixed object: Guardrail	None apparent	None apparent	33	Male
Non-collision events: Jackknife	None apparent	None apparent	42	Male

Table C.36. Detailed case-by-case listing for large vehicle crashes on the Cedar River Bridge, 2001 though Nov. 2008 (continued)

First Harmful Event	Driver Cond.	D. Cont. Circ. 1	Inj. Status
Collision with: Vehicle in traffic	Apparently normal	Swerved to avoid: vehicle-object-non-motorist-or animal in roadway	
	Apparently normal	Swerved to avoid: vehicle-object-non-motorist-or animal in roadway	
Collision with: Vehicle in traffic	Apparently normal	Other (explain in narrative): No improper action	Possible
	Apparently normal	Other (explain in narrative): No improper action	
	Unknown	Not Reported	
	Unknown	Unknown	
	Unknown	Unknown	
Non-collision events: Jackknife	Apparently normal	Other (explain in narrative): No improper action	Possible
Collision with: Vehicle in traffic	Apparently normal	Other (explain in narrative): Other improper action	
	Apparently normal	Other (explain in narrative): No improper action	
Collision with fixed object: Impact attenuator	Apparently normal	Driving too fast for conditions	
Collision with fixed object: Bridge/bridge rail/overpass	Unknown	Lost Control	Possible
Collision with: Vehicle in traffic	Apparently normal	Other (explain in narrative): No improper action	
	Not Reported	Not Reported	
Collision with: Vehicle in traffic	Apparently normal	Not Reported	
	Not Reported	Not Reported	
	Not Reported	Not Reported	
Non-collision events: Jackknife	Unknown	Lost Control	Fatal
Collision with: Vehicle in traffic	Apparently normal	Driving too fast for conditions	Non-incapacitating
Collision with: Vehicle in traffic	Apparently normal	Lost Control	Possible
Collision with fixed object: Guardrail	Apparently normal	Unknown	Possible
	Apparently normal	Swerved to avoid: vehicle-object-non-motorist-or animal in roadway	
	Apparently normal	Swerved to avoid: vehicle-object-non-motorist-or animal in roadway	
Collision with: Vehicle in/from other roadway	Apparently normal	Other (explain in narrative): No improper action	
	Not Reported	FTYROW: From yield sign	
Collision with fixed object: Bridge/bridge rail/overpass	Apparently normal	Lost Control	Possible
Non-collision events: Jackknife	Apparently normal	Lost Control	Possible
Collision with fixed object: Guardrail	Apparently normal	Lost Control	
Non-collision events: Jackknife	Apparently normal	Lost Control	Non-incapacitating

APPENDIX D. IMAGES FROM FIELD REVIEWS

Figure D.1. Road safety audit team

Figure D.2. Guide sign truss for northbound I-380 at US 30/US 218 interchange

Figure D.3. East terminal of northbound off-ramp at Wilson Avenue

Figure D.4. Northbound I-380 approaching Cedar River Bridge (note trees and large building on right)

Figure D.5. Northbound I-380 with view of large building on right side

Figure D.6. First Street West off-ramp for northbound I-380

Figure D.7. Cedar River (5 in 1) Bridge for northbound I-380 (note metal bridge rail)

Figure D.8. Northbound I-380 crossing Cedar River Bridge

Figure D.9. Northbound I-380 near Cedar Lake area

Figure D.10. Northbound I-380 approaching Collins Road off-ramp

Figure D.11. Northbound I-380 approaching Blairs Ferry Road off-ramp

Figure D.12. Westbound Boyson Road approaching west ramp terminal

Figure D.13. Westbound Blair's Ferry Road approaching east I-380 ramp terminal

Figure D.14. Southbound I-380 approaching H Avenue (note narrow median in this area)

Figure D.15. Changeable message sign on southbound I-380 approaching central business district

Figure D.16. Southbound I-380 approaching US 30/US 218 interchange

Figure D.17. Guide sign truss over southbound I-380 at US 30/US 218 ramp bifurcation

Figure D.18. Guide sign truss over US 30/US 218 southbound off-ramp